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**EarthFax**

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October 13, 2010

Mr. Daron Haddock  
Coal Regulatory Program  
Utah Division of Oil, Gas and Mining  
1594 West North Temple  
Suite 1210  
Salt Lake City, UT 84116

Subject: Wellington Dry Coal Cleaning Facility  
COVOL Engineered Fuels  
Permit No. C/007/0045  
Submittal of Updated Plates and Chapters

Dear Mr. Haddock:

On behalf of COVOL Engineered Fuels, we are pleased to submit the enclosed updates to plates and text that form a part of the operating permit for the Wellington Dry Coal Cleaning Facility. The text is submitted in redline/strikeout version for your easy review of the changes that have been made. We are also submitting herewith the appropriate C1 and C2 forms.

Please contact Ms Gina Rau of COVOL (801-984-3770) if you have any questions. Thank you for your assistance.

Sincerely,

Richard B. White, P.E.  
President  
EarthFax Engineering, Inc.

Enclosure

cc: Gina Rau

File in:

☐ Confidential  
☐ Shelf  
☒ Expandable

Date Folder 10/13/2010 C/007/0045

See Incoming For additional information

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**OCT 13 2010**

**DIV. OF OIL, GAS & MINING**

# APPLICATION FOR COAL PERMIT PROCESSING

**COPY**

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

**Permittee:** COVOL Engineered Fuels, LC

**Mine:** Wellington Dry Coal Cleaning Facility

**Permit Number:** C/007/0045

**Title:** Submittal of updated Plates 5-1 and 7-2 and Chapters 2 and 7

**Description:** Include reason for application and timing required to implement:

Submittal of updated plates and chapters as requested by Pete Hess, UDOGM Inspector.

**Instructions:** If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

- |   |   |
|---|---|
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ <input type="checkbox"/> increase <input type="checkbox"/> decrease. |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 2. Is the application submitted as a result of a Division Order? DO# _____  |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?                                     |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 4. Does the application include operations in hydrologic basins other than as currently approved?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 6. Does the application require or include public notice publication?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 7. Does the application require or include ownership, control, right-of-entry, or compliance information?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 9. Is the application submitted as a result of a Violation? NOV # _____   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 10. Is the application submitted as a result of other laws or regulations or policies?  |
| <i>Explain:</i> _____   |   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 11. Does the application affect the surface landowner or change the post mining land use?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)                                |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 13. Does the application require or include collection and reporting of any baseline information?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 15. Does the application require or include soil removal, storage or placement?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 16. Does the application require or include vegetation monitoring, removal or revegetation activities?  |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 17. Does the application require or include construction, modification, or removal of surface facilities?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 18. Does the application require or include water monitoring, sediment or drainage control measures?  |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 19. Does the application require or include certified designs, maps or calculation?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 20. Does the application require or include subsidence control or monitoring?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 21. Have reclamation costs for bonding been provided?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?  |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 23. Does the application affect permits issued by other agencies or permits issued to other entities?   |

**Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you.** (These numbers include a copy for the Price Field Office)

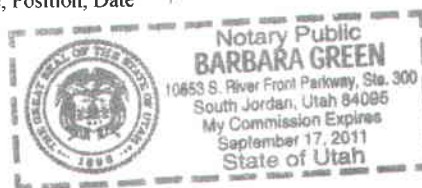
I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

John R Shael  
Print Name

John R Shael, VP-operations 10/7/10  
Sign Name, Position, Date

Subscribed and sworn to before me this 7<sup>th</sup> day of Oct., 2010

Barbara Green  
Notary Public  
My commission Expires: Sept. 17, 2011  
Attest: State of Utah  
County of Salt Lake ss:



**For Office Use Only:**

**Assigned Tracking Number:**

**Received by Oil, Gas & Mining**

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**OCT 13 2010**

**DIV. OF OIL, GAS & MINING**

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**Title:** Submittal of updated plates and chapters as requested by Pete Hess, UDOGM Inspector

DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED

[illegible]

# DIV. OF OIL, GAS & MINING

### **2.3.3 Topsoil Substitutes and Supplements**

#### **2.3.3.1 Overburden Materials Supplementing and/or Replacing Topsoil**

No overburden materials will be used in site reclamation.

#### **2.3.3.2 Suitability of Topsoil Substitutes and Supplements**

No topsoil substitutes or supplements are planned for use at the facility.

#### **2.3.3.3 Physical and Chemical Analyses**

No topsoil substitutes or supplements are planned for use at the facility. Hence, no physical or chemical analyses of substitute material are anticipated.

#### **2.3.3.4 Testing of Substitute Topsoil**

Since it will not be used at the site, no testing of substitute topsoil is anticipated.

### **2.3.4 Topsoil Storage**

#### **2.3.4.1 Topsoil Stockpiling**

Topsoil that was removed from the area during site grading is stored in ~~a~~ on-site stockpile~~s~~ (Section 2.3.1.4). Any topsoil removed from the site in the future will be stockpiled for later use in reclamation operations when it is impractical to promptly redistribute the topsoil on regraded areas.

#### **2.3.4.2 Stockpiled Topsoil**

**Stable Stockpile Site.** The topsoil removed from the site is stored in ~~a~~ small stockpile~~s~~ (approximately ~~56~~,500 square feet), located in a stable area in the southern portion of the permit area.



**Protection from Contaminants and Compaction.** Stockpiled topsoil will be located in areas away from traffic that might introduce contaminants and unnecessary compaction.

**Wind and Water Erosion Protection.** The topsoil stockpile~~s~~ will be protected from wind and water erosion by prompt establishment and maintenance of a vegetative cover. Silt fencing will be installed below the stockpile~~s~~ to help trap sediment runoff from the stockpile~~s~~.

**Topsoil Redistribution.** No stockpiled topsoil will be moved until redistributed during reclamation operations unless approved by DOGM.

#### **2.3.4.3 Topsoil Stockpile Relocation**

Stockpiled topsoil in jeopardy of being detrimentally affected in terms of its quantity and quality by facility operations may be temporarily redistributed.

**Host Site.** Topsoil relocation may occur provided that such action does not permanently adversely affect topsoil of the host site.

**Topsoil Suitability.** Topsoil relocation may occur provided the topsoil is retained in a condition more suitable for redistribution than if stockpiled.

### **2.40 Reclamation Plan**

#### **2.4.1 General Requirements**

Topsoil redistribution, amendments, and stabilization are discussed below.

#### **2.4.2 Soil Redistribution**

##### **2.4.2.1 Soil Redistribution Practices**

Under the industrial post-operation land-use scenario, the extent of the future redistribution of soil resources following facility shutdown is not currently known. However, for the sake of

which total 17.4 acres in area. The watershed contributing to the west sedimentation pond has been divided into three sub-watersheds which total 7.0 acres in area. The remaining 5.6 acres of the site are situated along the edges of the facility, outside of the diversion ditches, and is not disturbed. All of the area within the watersheds reporting to the ditches and the sedimentation ponds has been considered to be disturbed in the hydrology calculations.

The size and location of each existing diversion ditch and culvert were mapped using an aerial photograph of the site and verified in the field. All diversions are shown on Plate 7-2. The capacity and freeboard of each diversion ditch were determined based on the minimum ditch slope, while the maximum velocity and need for erosion protection were verified based on the maximum ditch slope. The capacity of each culvert was determined using the minimum culvert slope and the outlet velocity and riprap protection was verified using the culvert outlet slope. Slopes were measured from a pre-construction contour map of the site. A description of the methods used to determine diversion capacities, flow velocities, and erosion protection requirements is presented in Appendix 7-6. All diversion calculations are presented in Appendix 7-8.

**Diversion of Perennial and Intermittent Streams.** There are no diversions of perennial or intermittent streams at the facility.

**Diversion Ditches and Culverts.** A summary table of the geometry, channel slope, peak discharge, erosion protection, maximum flow velocity and minimum depth values for each diversion ditch and culvert at the facility is presented in Table 7-3. Diversion hydrology calculations are detailed in Appendix 7-8. Each ditch and culvert has been constructed to safely non-erosively convey ~~pass~~ the peak flow resulting from the ~~100~~25-year, 6-hour precipitation event and to contain the flow resulting from the 100-year, 6-hour precipitation event. A description of the diversion ditches and culverts within the facilities area is presented below and in Table 7-2. The ditches are named according to the watersheds that they drain. Ditches prefixed by the letter "E" ultimately report to the east sedimentation pond, and ditches prefixed by the letter "W" ultimately report to the west sedimentation pond. Since some watersheds are drained by culverts instead of

ditches, the ditches are not numbered strictly chronologically. Refer to Plate 7-2 for the locations of each watershed and diversion structure.

- **Ditch E-1 (Upper).** This ditch exists on the east edge of the permit area just within the permit area boundary. It conveys runoff from the northern portion and eastern edge of the site southward toward the east sedimentation pond. ~~This V-shaped ditch is approximately 1,100 feet long, is 1.5 feet deep, and has 1H:1V side slopes. It begins at the outlet of culvert C-1 and continues to the outlet of culvert C-2.~~
- **Ditch E-1 (Lower).** This ditch conveys runoff southward from the outlet of culvert C-2 to culvert C-7 at the inlet of the east sedimentation pond. ~~This V-shaped ditch is approximately 700 feet long, has 1.5H:1V side slopes, and is 1.5 feet deep.~~
- **Ditch E-3.** This ditch conveys runoff from the southeastern corner of the inner yard to the east sedimentation pond. ~~This trapezoidal ditch has an eastern side slope of 1H:1V and a western side slope of 2.5H:1V. It is 1.5 feet deep, has a 6-inch bottom width, and is approximately 550 feet long.~~
- **Ditch E-4.** This ditch conveys runoff southward from the region between the top of the truck dump hopper embankment and the road on the east edge of the permit area. ~~This V-shaped ditch has an eastern side slope of 3H:1V and a western side slope of 1H:1V. It is one foot deep and approximately 950 feet long.~~
- **Ditch E-5.** This ditch conveys runoff eastward along the southern edge of the permit area toward the east sedimentation pond. It captures runoff from the eastern watershed of the inner yard that is not captured by ditch E-3. ~~Ditch E-5 is V-shaped with 4H:1V side slopes. It is 1 foot deep and approximately 515 feet long.~~
- **Ditch W-1 (Upper).** This ditch runs along the west edge of the permit area ~~just within the permit area boundary.~~ It conveys runoff from the northern portion and western edge of the site southward toward the west sedimentation pond. ~~This V-shaped ditch has 2H:1V side slopes. It is 2 feet deep and approximately 1,400 feet long. It begins just west of the northwest corner of the yard access road and extends to the outlet of culvert C-3.~~
- **Ditch W-1 (Lower).** This ditch runs from the outlet of culvert C-3 to culvert C-5 at the inlet of the west sedimentation pond. It conveys runoff from the W-1 (Upper) Ditch and the W-2 Ditch into the west sedimentation pond. ~~Ditch W-1 (Lower) is V-shaped with 2H:1V side slopes. It is 2 feet deep and approximately 700 feet long.~~

- **Ditch W-2.** This ditch runs on the east side of the silo and its access road, and drains the area located to the east. It drains into culvert C-3, which feeds into Ditch W-1 (Lower). ~~Ditch W-2 is V-shaped with a western side slope of 4.5H:1V and an eastern side slope of 1H:1V. It is 1 foot deep and approximately 1,050 feet long.~~
- **Ditch W-3.** This ditch conveys runoff westward along the southern edge of the permit area toward the west sedimentation pond. It captures runoff from the area south of the perimeter access road that drains toward the west sedimentation pond. ~~Ditch W-3 is V-shaped with 4H:1V side slopes. It is 1 foot deep and approximately 395 feet long.~~
- **Culvert C-1.** This culvert conveys runoff from watershed E-2 under the truck turn-around road in the northeastern corner of the site. It provides drainage for the area enclosed by the road embankments for the yard perimeter road and the truck turn-around. ~~The culvert is 45 feet long and consists of 18-inch diameter corrugated polyethylene pipe. Riprap with a median diameter of 3 inches will be placed in the channel bottom for a distance of 10 feet downstream from the culvert outlet to provide erosion protection.~~
- **Culvert C-2.** This culvert conveys runoff under the road in the southeastern corner of the permit area. It provides drainage for the area enclosed by the road embankments for watershed E-4, including the yard perimeter road and the truck dump hopper. ~~The culvert is 45 feet long and consists of 18-inch diameter corrugated polyethylene pipe.~~
- **Culvert C-3.** This culvert conveys runoff under the road in the southwestern corner of the permit area. It provides a route for drainage from Ditch W-2 to travel under the road and into Ditch W-1 (Lower). ~~The culvert is 30 feet long and is constructed from 18-inch diameter corrugated polyethylene pipe. Riprap with a median diameter of 3 inches will be placed in the channel bottom for a distance of 10 feet downstream from the culvert outlet to provide erosion protection.~~
- **Culvert C-4.** This culvert is installed within Ditch W-1 (Lower) to allow vehicular access into the area south of the Loop Road.
- **Culvert C-5.** This culvert is installed at the inlet to the west sedimentation pond. Riprap with a minimum median diameter of 6 inches has been installed at the outlet of this culvert to provide erosion protection.
- **Culvert C-6.** This culvert is installed beneath the southeast corner of the Loop Road and extends a sufficient distance to allow vehicular access from the east to the area south of the road.

- Culvert C-7. This culvert is installed at the inlet to the east sedimentation pond. Riprap with a minimum median diameter of 10 inches has been installed at this outlet of this culvert to provide erosions protection.

#### **7.4.2.4 Road Drainage**

Roads at the facility include an access road that leads from Ridge Road into the main yard, a road around the perimeter of the main yard, and a truck turnaround north of the main yard. All of the roads have been constructed to include adequate drainage control with the use of diversion ditches, culverts, and containment berms. None of the roads are located in the channel of an intermittent or perennial stream. All roads have been located to minimize downstream



**TABLE 7-2**

Summary of Sedimentation Pond Data

|  | East Pond | West Pond |
|--|-----------|-----------|
| Assumed bottom elevation (ft)  | 5,493.8   | 5,498.2   |
| Assumed crest elevation (ft)   | 5,505.8   | 5,510.0   |
| Total Storage Capacity (ft <sup>3</sup> )  | 53,900    | 36,070    |
| Calculated Annual Sediment Volume (ft <sup>3</sup> )   | 333       | 134       |
| 10-Year, 24-Hour Precip. Runoff Volume (ft <sup>3</sup> )  | 36,970    | 14,850    |
| Sediment Storage Capacity (ft <sup>3</sup> )   | 16,930    | 21,220    |
| 60% Sediment Storage Cleanout Volume (ft <sup>3</sup> )  | 10,160    | 12,730    |
| Sediment Cleanout Elevation (ft)   | 5,498.6   | 5,505.4   |
| Peak Stage of 10-Year, 24-Hour Precipitation Event Plus 60% Sediment Storage Capacity (ft)   | 5,503.0   | 5,506.4   |
| Invert elevation of 3-foot wide armored spillway (ft)  | 5,503.7   | 5,508.0   |
| Peak Pond Inflow Due to 25-Year, 6-Hour Precipitation Event (cfs)  | 9.9924    | 3.242.70  |
| Peak Pond Outflow due to 25-Year, 6-Hour Precipitation Event (cfs)   | 2.2926    | 0.0829    |
| Peak Pond Outflow Velocity due to 25-Year, 6-Hour Precipitation Event (fps)  | 2.0       | 0.58      |
| Peak Stage of 25-Year, 6-Hour Precipitation Event Following a 10-Year, 24-Hour Precipitation Event with Pond Full to 60% of Sediment Storage Capacity (ft) | 5,504.3   | 5,508.01  |

Notes:

- Refer to Appendix 7-7 for calculations related to sedimentation pond design
- Pond dimensions were surveyed by EIS Environmental and Engineering Consulting in November 2007. Absolute elevations were assumed by superimposing the survey data on the pre-construction topography provided by Mine and Mill Engineering. Each pond has a berm extending approximately 2 ft above the ground surface.

**TABLE 7-3**

**Summary of Drainage Ditch and Culvert Data**

| Structure       | Description  | Peak Flow<br>(cfs) <sup>(a)</sup> | Max. Flow<br>Depth<br>(ft) <sup>(b)</sup> | Max. Flow<br>Velocity<br>(fps) <sup>(c)</sup> | Required<br>Riprap D <sub>50</sub><br>(in) |
|-----------------|--|-----------------------------------|---|---|--|
| <b>Ditches</b>  |  |                                   |   |   |  |
| E-1 Upper       | Triangular, 1:1 sides, 1.5' deep                           | 1.75                              | 0.91                                      | 2.57  | None                                       |
| E-1 Lower       | Triangular, 1.5:1 sides, 1.5' deep                         | 1.75                              | 0.73                                      | 2.62  | None                                       |
| E-3             | Trapezoidal, 2.5:1 left, 1:1 right, 0.5' bottom, 1.5' deep | 4.80                              | 0.84                                      | 3.41  | None                                       |
| E-4             | Triangular, 2:1 left, 1:1 right, 1.2' deep                 | 1.16                              | 0.60                                      | 2.12  | None                                       |
| E-5             | Triangular, 4:1 sides, 1.0' deep                           | 4.98                              | 0.76                                      | 3.40  | None                                       |
| W-1 Upper       | Triangular, 2:1 sides, 2.0' deep                           | 1.50                              | 0.65                                      | 2.60  | None                                       |
| W-1 Lower       | Triangular, 2:1 sides, 2.0' deep                           | 2.44                              | 0.83                                      | 2.54  | None                                       |
| W-2             | Trapezoidal, 1:1 left, 2:1 right, 2.0' bottom, 1.0' deep   | 2.79                              | 0.51                                      | 3.20  | None                                       |
| W-3             | Triangular, 4.5:1 left, 1:1 right, 1.0' deep               | 1.81                              | 0.74                                      | 2.54  | None                                       |
| <b>Culverts</b> |  |                                   |   |   |  |
| C-1             | Corrugated, 18" diameter                                   | 1.40                              | 0.35                                      | 4.46  | None                                       |
| C-2             | Corrugated, 18" diameter                                   | 0.63                              | 0.24                                      | 3.45  | None                                       |
| C-3             | Corrugated, 18" diameter                                   | 2.23                              | 0.49                                      | 4.51  | None                                       |
| C-4             | Corrugated, 18" diameter                                   | 1.17                              | 0.44                                      | 2.76  | None                                       |
| C-5             | Corrugated, 18" diameter                                   | 2.70                              | 0.34                                      | 9.02  | 6  |
| C-6             | Corrugated, 18" diameter                                   | 4.80                              | 0.83                                      | 4.83  | None                                       |
| C-7             | Corrugated, 18" diameter                                   | 9.24                              | 0.69                                      | 11.54   | 10   |

<sup>(a)</sup> 25-yr, 6-hr event (see Appendix 7-7)

<sup>(b)</sup> Based on minimum channel slope (see Appendix 7-8)

<sup>(c)</sup> Based on maximum channel slope (see Appendix 7-8)

## **APPENDIX 7-7**

### **Sedimentation Pond Hydrology Calculations**

WATERSHED HYDROLOGY MODEL SUMMARIES  
COVOL ENGINEERED FUELS  
WELLINGTON DRY-COAL CLEANING FACILITY

Watersheds Reporting to East Sedimentation Pond

| Watershed | Area (ft <sup>2</sup> ) | Avg. Slope (%) | Curve Number | Hydraulic Length (ft) | 10-Year, 24-Hour Storm Runoff Volume (ft <sup>3</sup> ) | 25-Year, 6-Hour Storm Runoff Volume (ft <sup>3</sup> ) |
|-----------|-------------------------|----------------|--------------|-----------------------|---|--|
| E-1       | 88,103                  | 0.021          | 87           | 1,752                 | 4,290   | 2,902  |
| E-2       | 66,123                  | 0.021          | 87           | 581                   | 3,220   | 2,178  |
| E-3       | 28,991                  | 0.03           | 87           | 1,091                 | 14,120  | 9,552  |
| E-4       | 29,947                  | 0.25           | 87           | 561                   | 1,458   | 986  |
| E-5       | 285,103                 | 0.025          | 87           | 925                   | 13,882  | 9,391  |

Watersheds Reporting to West Sedimentation Pond

| Watershed | Area (ft <sup>2</sup> ) | Avg. Slope (%) | Curve Number | Hydraulic Length (ft) | 10-Year, 24-Hour Storm Runoff Volume (ft <sup>3</sup> ) | 25-Year, 6-Hour Storm Runoff Volume (ft <sup>3</sup> ) |
|-----------|-------------------------|----------------|--------------|-----------------------|---|--|
| W-1       | 105,474                 | 0.025          | 87           | 1,297                 | 5,136   | 3,474  |
| W-2       | 128,724                 | 0.025          | 87           | 635                   | 6,268   | 4,240  |
| W-3       | 70,836                  | 0.027          | 87           | 447                   | 3,449   | 2,333  |

Note: Curve Number assumed to be 87, which corresponds to a dirt road designation for Hydrologic Soil Group C (National Engineering Handbook, Section 4, Chapter 9)

Refer to attached HydroCAD 8.5 output for additional information

SEDIMENT YIELD CALCULATIONS  
COVOL ENGINEERED FUELS  
WELLINGTON DRY-COAL CLEANING FACILITY

| Watershed | Area<br>(sq ft) | R | K    | LS   | VM   | A<br>(tons/ac/yr) | Density<br>(pcf) | Annual Sediment Volume<br>(cubic ft/yr) |
|-----------|-----------------|---|------|------|------|-------------------|------------------|---|
| East Pond | 759,267         | 8 | 0.37 | 0.24 | 1.48 | 1.051             | 110              | 333                                     |
| West Pond | 305,033         | 8 | 0.37 | 0.24 | 1.48 | 1.051             | 110              | 134                                     |

Notes

A = R K LS VM, after Isrealsen et al, 1984

R is the rainfall factor, and is taken from a map in Isrealson et al., 1984

K is the soil erodibility factor for the Persayo-Chipeta Complex, as published by the NRCS

LS is the topographic factor, which is based on the length and steepness of the slope at the site. A slope length of 100 feet and a simple slope steepness of 2.5% was used. The value of LS was taken from Isrealsen et al., 1984, Table 2.

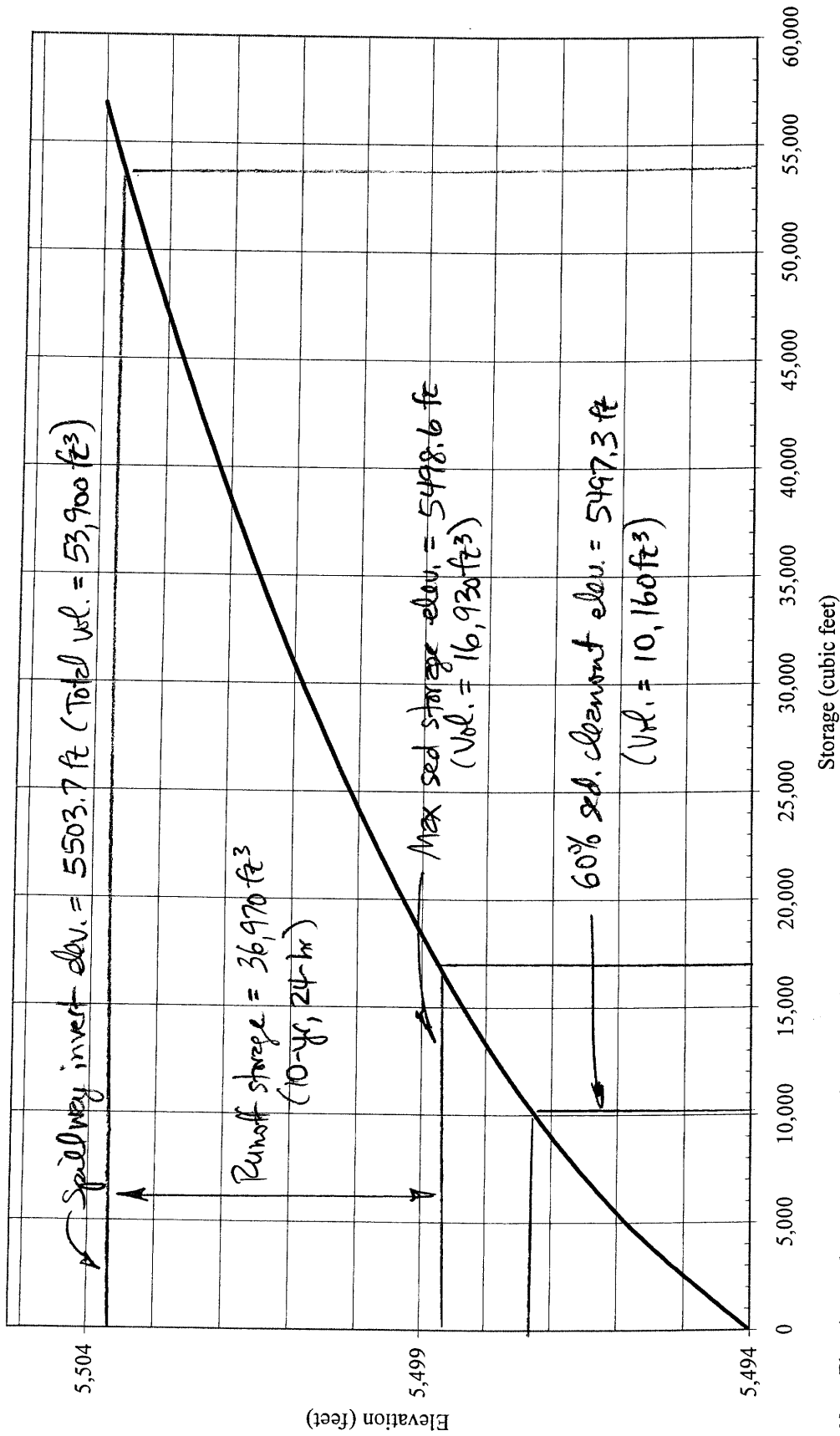
VM is the erosion control factor, which was taken to be 1.48, which is the value for compacted fill as specified by Israelsen, et al., 1984, Table 3.

Density assumed to be 110 pcf

Reference:

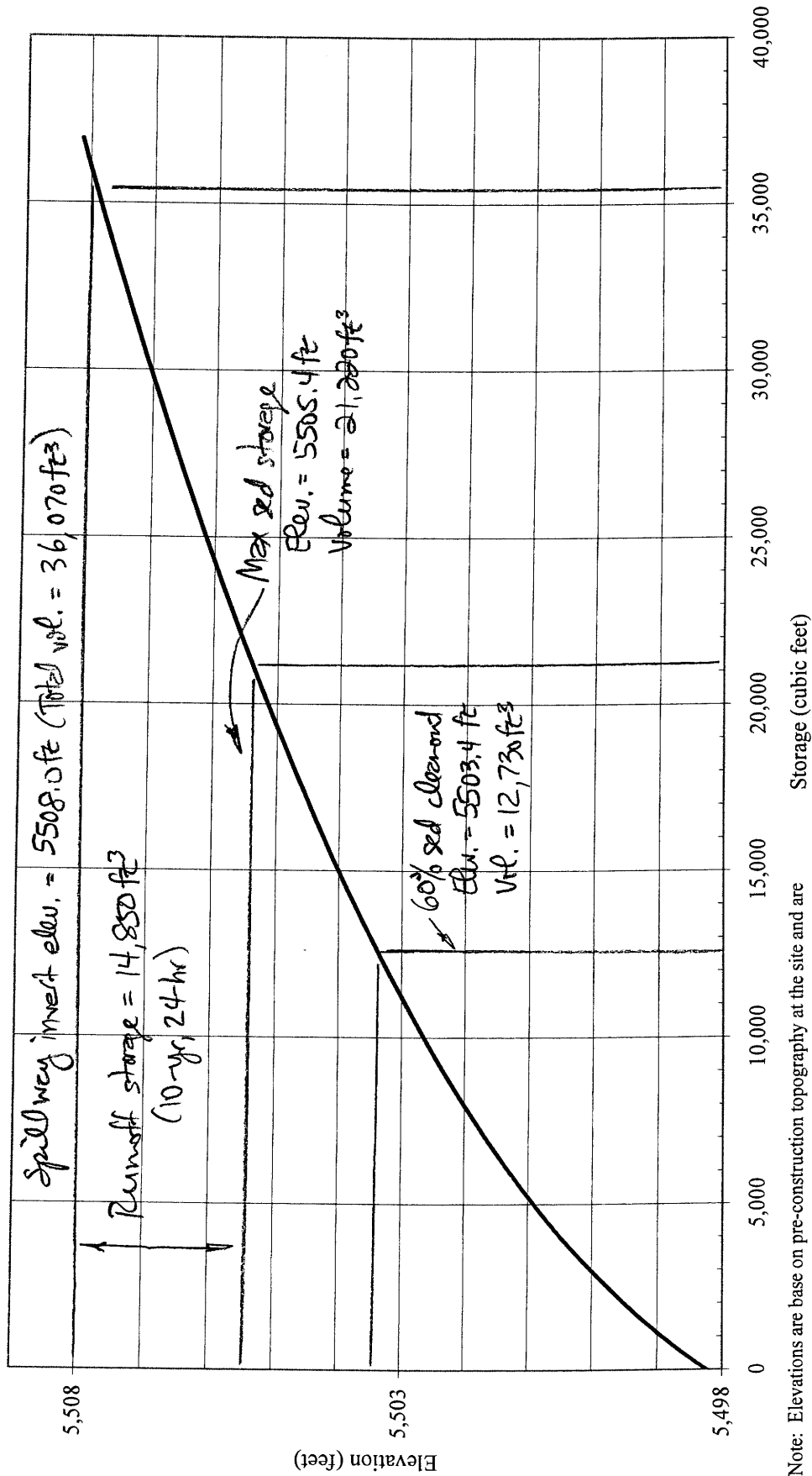
Isrealsen, C. Earl, Joel E. Fletcher, Frank W. Haws, and Eugene K. Isrealsen, 1984. *Erosion and Sedimentation in Utah: A Guide for Control*. Utah Water Research Laboratory, College of Engineering, Utah State University. Hydraulics and Hydrology Series UWRL/H-84/03.





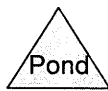
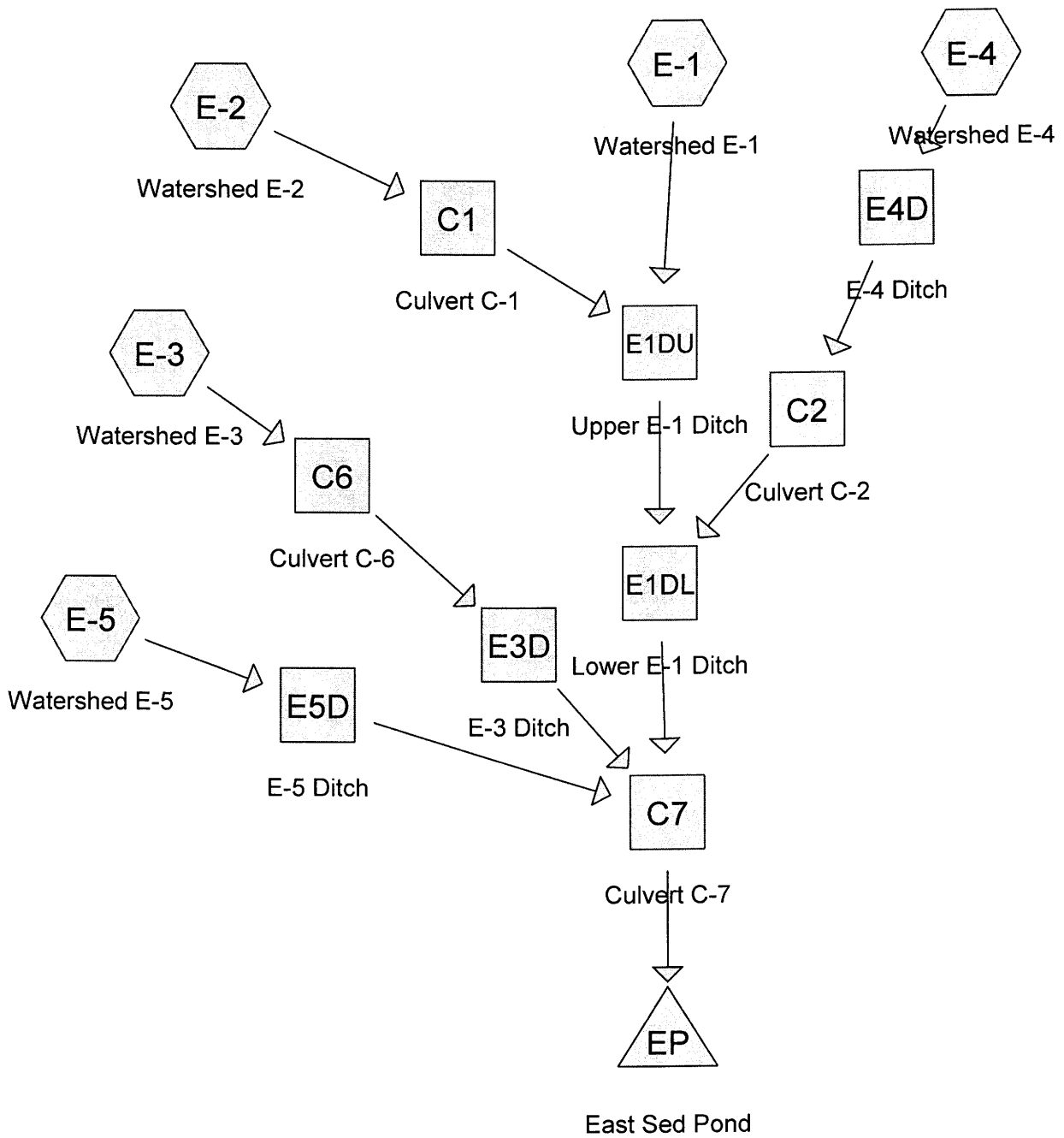
Note: Elevations are based on pre-construction topography at the site and are thus considered approximate. The dimensions and geometry of the sedimentation pond were surveyed by EIS Environmental and Engineering Consultants in November 2007. The bottom of the sedimentation pond was measured to be 10.2 feet below the surrounding ground surface, which is at an elevation of approximately 5,504.0 feet.

## EAST POND STAGE VS. STORAGE



Note: Elevations are based on pre-construction topography at the site and are thus considered approximate. The dimensions and geometry of the sedimentation pond were surveyed by EIS Environmental and Engineering Consultants in November 2007. The bottom of the sedimentation pond was measured to be 9.8 feet below the surrounding ground surface, which is at an elevation of approximately 5,508.0 feet.

## WEST POND STAGE VS. STORAGE



# **Drainage Diagram for 10yr-24hr East Pond**

Prepared by EarthFax Engineering, Inc., Printed 9/17/2010  
 HydroCAD® 8.50 s/n 003900 © 2007 HydroCAD Software Solutions LLC

**10yr-24hr East Pond**

Prepared by EarthFax Engineering, Inc.

HydroCAD® 8.50 s/n 003900 © 2007 HydroCAD Software Solutions LLC

Printed 9/17/2010 12:43:26 PM

Page 2

**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN | Description<br>(subcatchment-numbers) |
|-----------------|----|---------------------------------------|
| <b>759,267</b>  | 87 | (E-1,E-2,E-3,E-4,E-5)                 |
| 759,267         |    | <b>TOTAL AREA</b>                     |

**10yr-24hr East Pond**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 0               | HSG A         |                         |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| <b>759,267</b>  | Other         | E-1, E-2, E-3, E-4, E-5 |
| 759,267         |               | <b>TOTAL AREA</b>       |



**10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E-1: Watershed E-1** Runoff Area=88,103 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=1,752' Slope=0.0210 '/' Tc=27.1 min CN=87 Runoff=1.05 cfs 4,290 cf

**Subcatchment E-2: Watershed E-2** Runoff Area=66,123 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=581' Slope=0.0210 '/' Tc=11.2 min CN=87 Runoff=1.28 cfs 3,220 cf

**Subcatchment E-3: Watershed E-3** Runoff Area=289,991 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=1,091' Slope=0.0300 '/' Tc=15.5 min CN=87 Runoff=4.81 cfs 14,120 cf

**Subcatchment E-4: Watershed E-4** Runoff Area=29,947 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=561' Slope=0.2500 '/' Tc=3.2 min CN=87 Runoff=0.78 cfs 1,458 cf

**Subcatchment E-5: Watershed E-5** Runoff Area=285,103 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=925' Slope=0.0250 '/' Tc=14.9 min CN=87 Runoff=4.82 cfs 13,882 cf

**Reach C1: Culvert C-1** Avg. Depth=0.33' Max Vel=4.37 fps Inflow=1.28 cfs 3,220 cf  
D=18.0" n=0.020 L=40.0' S=0.0300 '/' Capacity=11.83 cfs Outflow=1.27 cfs 3,220 cf

**Reach C2: Culvert C-2** Avg. Depth=0.23' Max Vel=3.34 fps Inflow=0.59 cfs 1,458 cf  
D=18.0" n=0.020 L=40.0' S=0.0275 '/' Capacity=11.32 cfs Outflow=0.58 cfs 1,459 cf

**Reach C6: Culvert C-6** Avg. Depth=0.83' Max Vel=4.82 fps Inflow=4.81 cfs 14,120 cf  
D=18.0" n=0.025 L=200.0' S=0.0225 '/' Capacity=8.19 cfs Outflow=4.73 cfs 14,120 cf

**Reach C7: Culvert C-7** Avg. Depth=0.73' Max Vel=11.79 fps Inflow=9.98 cfs 36,970 cf  
D=18.0" n=0.025 L=20.0' S=0.1500 '/' Capacity=21.16 cfs Outflow=9.98 cfs 36,970 cf

**Reach E1DL: Lower E-1 Ditch** Avg. Depth=0.73' Max Vel=2.50 fps Inflow=2.00 cfs 8,968 cf  
n=0.035 L=287.0' S=0.0171 '/' Capacity=13.67 cfs Outflow=1.98 cfs 8,968 cf

**Reach E1DU: Upper E-1 Ditch** Avg. Depth=0.86' Max Vel=2.35 fps Inflow=1.93 cfs 7,510 cf  
n=0.035 L=720.0' S=0.0150 '/' Capacity=7.67 cfs Outflow=1.73 cfs 7,509 cf

**Reach E3D: E-3 Ditch** Avg. Depth=0.78' Max Vel=3.17 fps Inflow=4.73 cfs 14,120 cf  
n=0.035 L=283.0' S=0.0194 '/' Capacity=21.95 cfs Outflow=4.58 cfs 14,120 cf

**Reach E4D: E-4 Ditch** Avg. Depth=0.48' Max Vel=1.80 fps Inflow=0.78 cfs 1,458 cf  
n=0.035 L=561.0' S=0.0159 '/' Capacity=7.21 cfs Outflow=0.59 cfs 1,458 cf

**Reach E5D: E-5 Ditch** Avg. Depth=0.72' Max Vel=2.00 fps Inflow=4.82 cfs 13,882 cf  
n=0.035 L=746.0' S=0.0091 '/' Capacity=10.01 cfs Outflow=4.11 cfs 13,882 cf

**Pond EP: East Sed Pond** Peak Elev=5,501.61' Storage=36,970 cf Inflow=9.98 cfs 36,970 cf  
Outflow=0.00 cfs 0 cf

**Total Runoff Area = 759,267 sf Runoff Volume = 36,970 cf Average Runoff Depth = 0.58"**  
**100.00% Pervious = 759,267 sf 0.00% Impervious = 0 sf**

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Type II 24-hr Rainfall=1.57"

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**Summary for Subcatchment E-1: Watershed E-1**

Runoff = 1.05 cfs @ 12.22 hrs, Volume= 4,290 cf, Depth= 0.58"

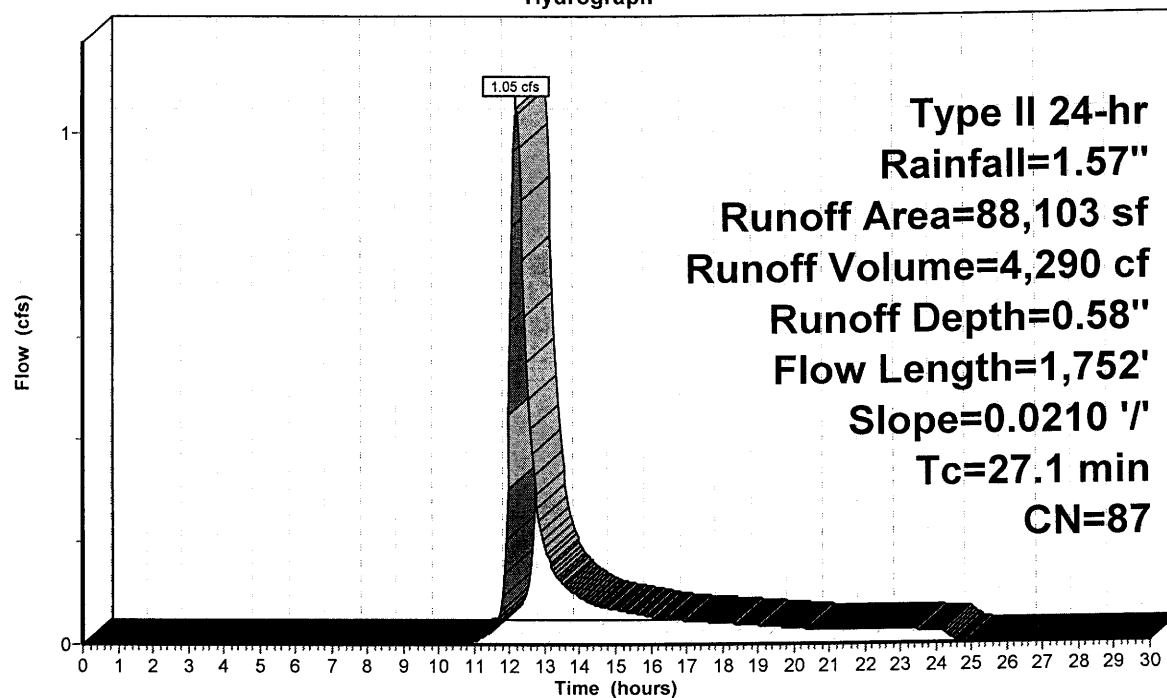
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=1.57"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 88,103    | 87 |               |
|   | 88,103    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 27.1        | 1,752            | 0.0210           | 1.08                 |                   | Lag/CN Method, |

**Subcatchment E-1: Watershed E-1**

Hydrograph



**10yr-24hr East Pond**

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**Summary for Subcatchment E-2: Watershed E-2**

Runoff = 1.28 cfs @ 12.04 hrs, Volume= 3,220 cf, Depth= 0.58"

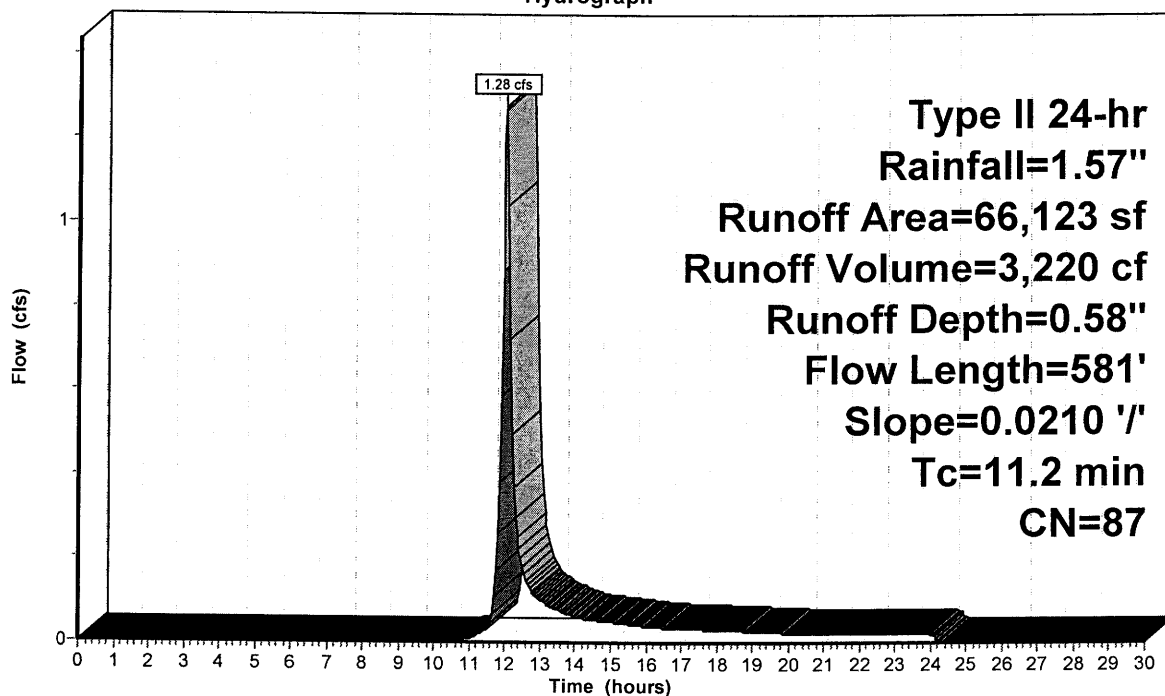
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=1.57"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 66,123    | 87 |               |
|   | 66,123    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 11.2        | 581              | 0.0210           | 0.86                 |                   | Lag/CN Method, |

**Subcatchment E-2: Watershed E-2**

Hydrograph



**10yr-24hr East Pond**

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**Summary for Subcatchment E-3: Watershed E-3**

Runoff = 4.81 cfs @ 12.09 hrs, Volume= 14,120 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

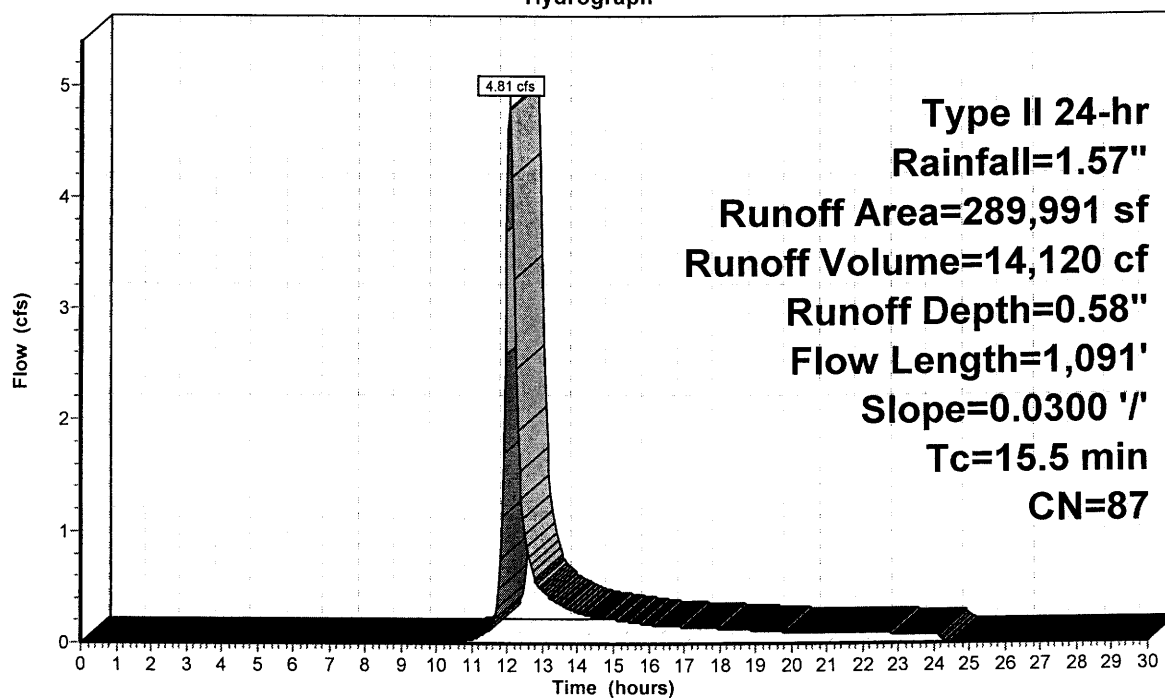
Type II 24-hr Rainfall=1.57"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 289,991 | 87 |               |
| 289,991   |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 15.5     | 1,091         | 0.0300        | 1.17              |                | Lag/CN Method, |

**Subcatchment E-3: Watershed E-3**

Hydrograph



Runoff

**10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Subcatchment E-4: Watershed E-4**[49] Hint:  $T_c < 2dt$  may require smaller  $dt$ 

Runoff = 0.78 cfs @ 11.94 hrs, Volume= 1,458 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs,  $dt=0.05$  hrs

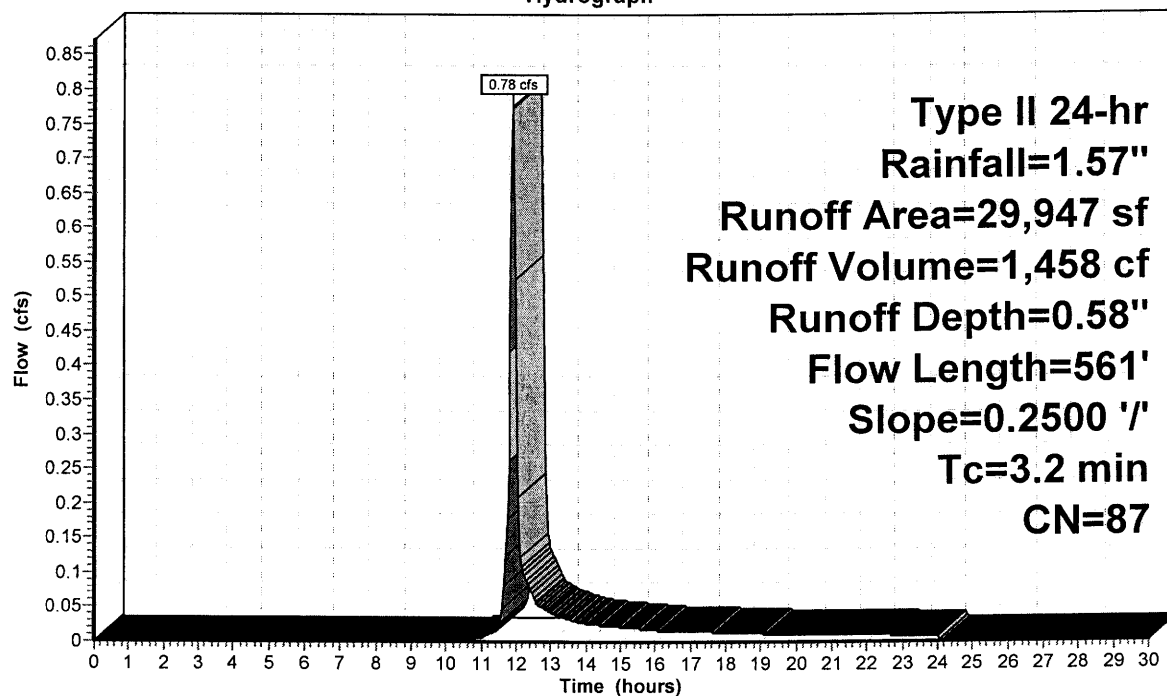
Type II 24-hr Rainfall=1.57"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 29,947    | 87 |               |
|   | 29,947    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 3.2         | 561              | 0.2500           | 2.96                 |                   | Lag/CN Method, |

**Subcatchment E-4: Watershed E-4**

Hydrograph





**10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Subcatchment E-5: Watershed E-5**

Runoff = 4.82 cfs @ 12.08 hrs, Volume= 13,882 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

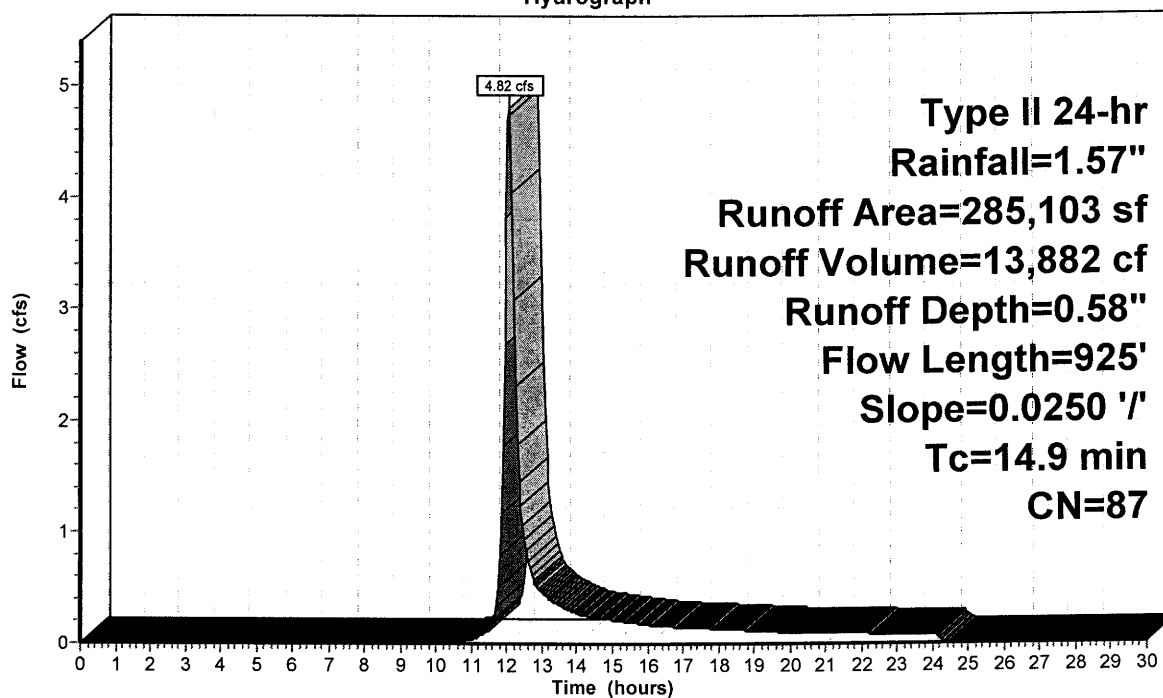
Type II 24-hr Rainfall=1.57"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 285,103 | 87 |               |
| 285,103   |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 14.9        | 925              | 0.0250           | 1.04                 |                   | Lag/CN Method, |

**Subcatchment E-5: Watershed E-5**

Hydrograph



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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach C1: Culvert C-1**

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 66,123 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 1.28 cfs @ 12.04 hrs, Volume= 3,220 cf  
 Outflow = 1.27 cfs @ 12.04 hrs, Volume= 3,220 cf, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.37 fps, Min. Travel Time= 0.2 min

Avg. Velocity= 1.51 fps, Avg. Travel Time= 0.4 min

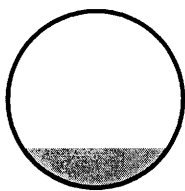
Peak Storage= 12 cf @ 12.04 hrs, Average Depth at Peak Storage= 0.33'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.83 cfs

18.0" Diameter Pipe, n= 0.020 Corrugated PE, corrugated interior

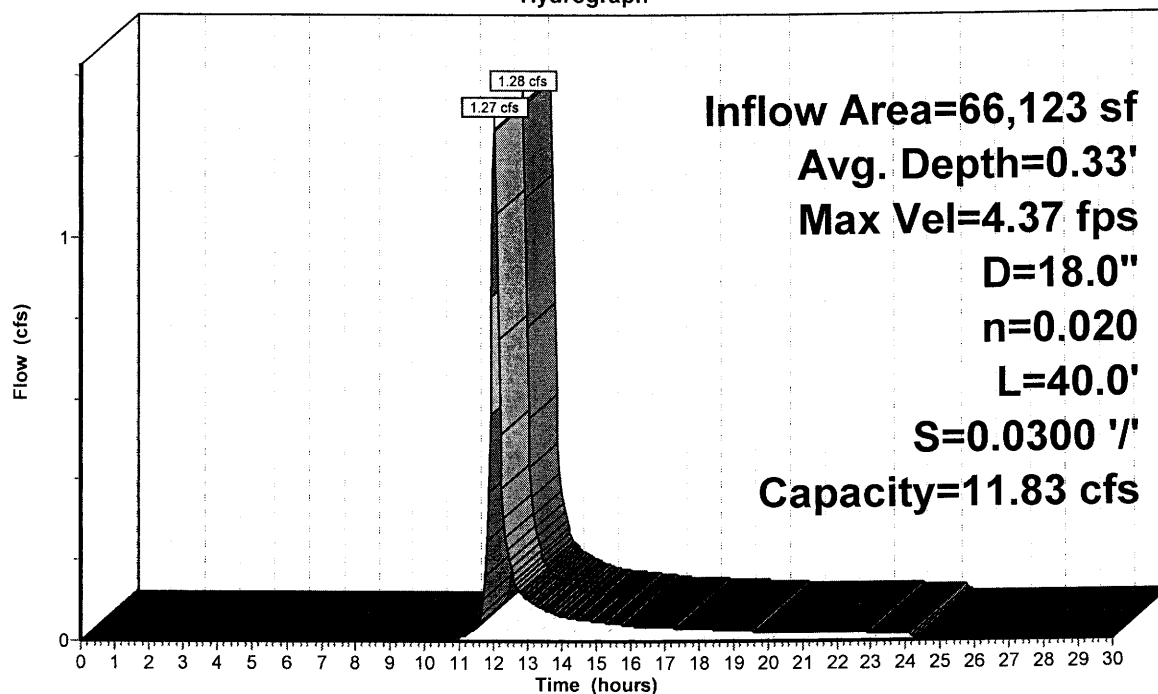
Length= 40.0' Slope= 0.0300 '/'

Inlet Invert= 5,520.70', Outlet Invert= 5,519.50'



## **Reach C1: Culvert C-1**

### **Hydrograph**



# **10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach C2: Culvert C-2**

[52] Hint: Inlet/Outlet conditions not evaluated

[61] Hint: Exceeded Reach E4D outlet invert by 0.23' @ 12.10 hrs

Inflow Area = 29,947 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 0.59 cfs @ 12.08 hrs, Volume= 1,458 cf  
 Outflow = 0.58 cfs @ 12.08 hrs, Volume= 1,459 cf, Atten= 2%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2

Max. Velocity= 3.34 fps, Min. Travel Time= 0.2 min

Avg. Velocity= 1.12 fps, Avg. Travel Time= 0.6 min

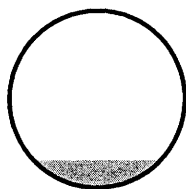
Peak Storage= 7 cf @ 12.08 hrs, Average Depth at Peak Storage= 0.23'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.32 cfs

18.0" Diameter Pipe, n= 0.020 Corrugated PE, corrugated interior

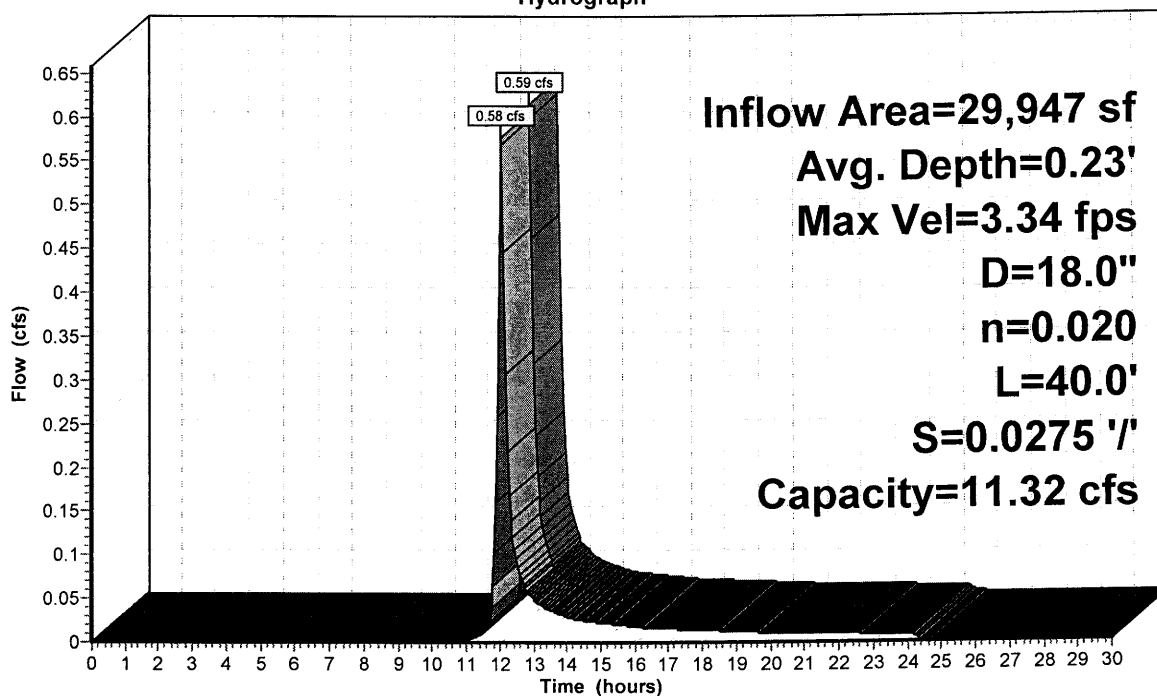
Length= 40.0' Slope= 0.0275 '/'

Inlet Invert= 5,509.80', Outlet Invert= 5,508.70'



## **Reach C2: Culvert C-2**

### **Hydrograph**



■ Inflow  
 ■ Outflow

# **10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach C6: Culvert C-6**

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 289,991 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 4.81 cfs @ 12.09 hrs, Volume= 14,120 cf  
 Outflow = 4.73 cfs @ 12.11 hrs, Volume= 14,120 cf, Atten= 2%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.82 fps, Min. Travel Time= 0.7 min

Avg. Velocity = 1.76 fps, Avg. Travel Time= 1.9 min

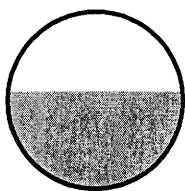
Peak Storage= 199 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.83'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 8.19 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

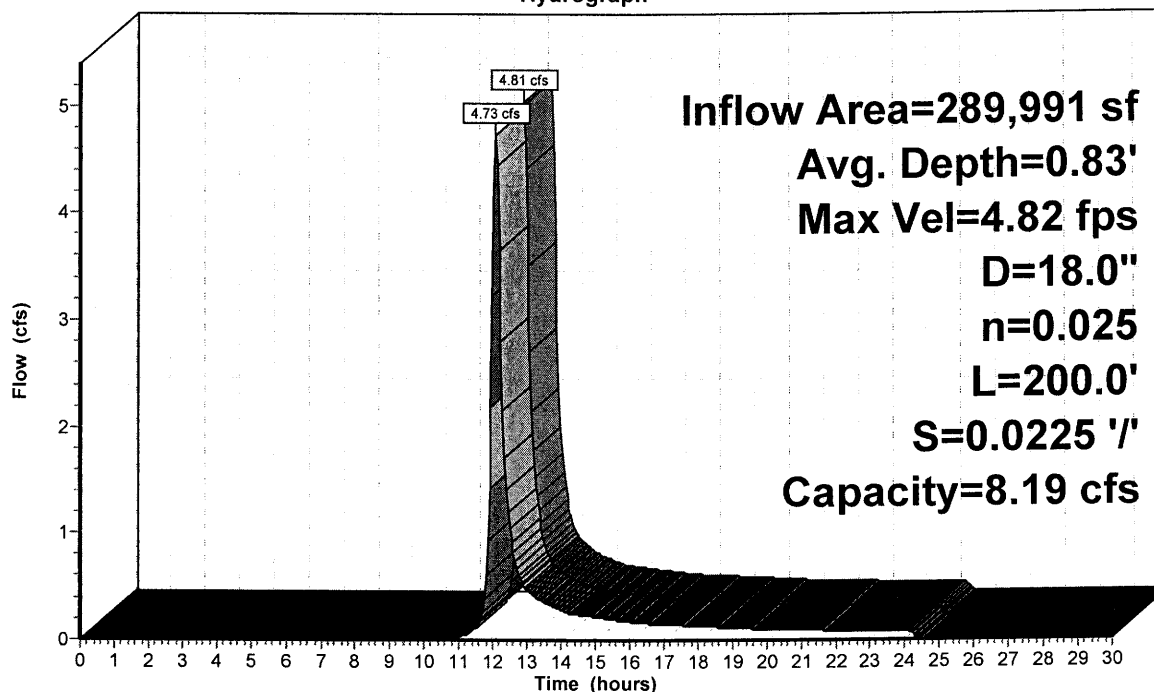
Length= 200.0' Slope= 0.0225 '/'

Inlet Invert= 5,514.00', Outlet Invert= 5,509.50'



## **Reach C6: Culvert C-6**

### **Hydrograph**



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## **Summary for Reach C7: Culvert C-7**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach E1DL OUTLET depth by 1.20' @ 10.30 hrs

[62] Warning: Exceeded Reach E3D OUTLET depth by 1.08' @ 12.35 hrs

[62] Warning: Exceeded Reach E5D OUTLET depth by 1.25' @ 12.30 hrs

Inflow Area = 759,267 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 9.98 cfs @ 12.21 hrs, Volume= 36,970 cf  
 Outflow = 9.98 cfs @ 12.21 hrs, Volume= 36,970 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 11.79 fps, Min. Travel Time= 0.0 min

Avg. Velocity= 4.03 fps, Avg. Travel Time= 0.1 min

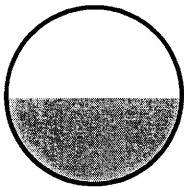
Peak Storage= 17 cf @ 12.21 hrs, Average Depth at Peak Storage= 0.73'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 21.16 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

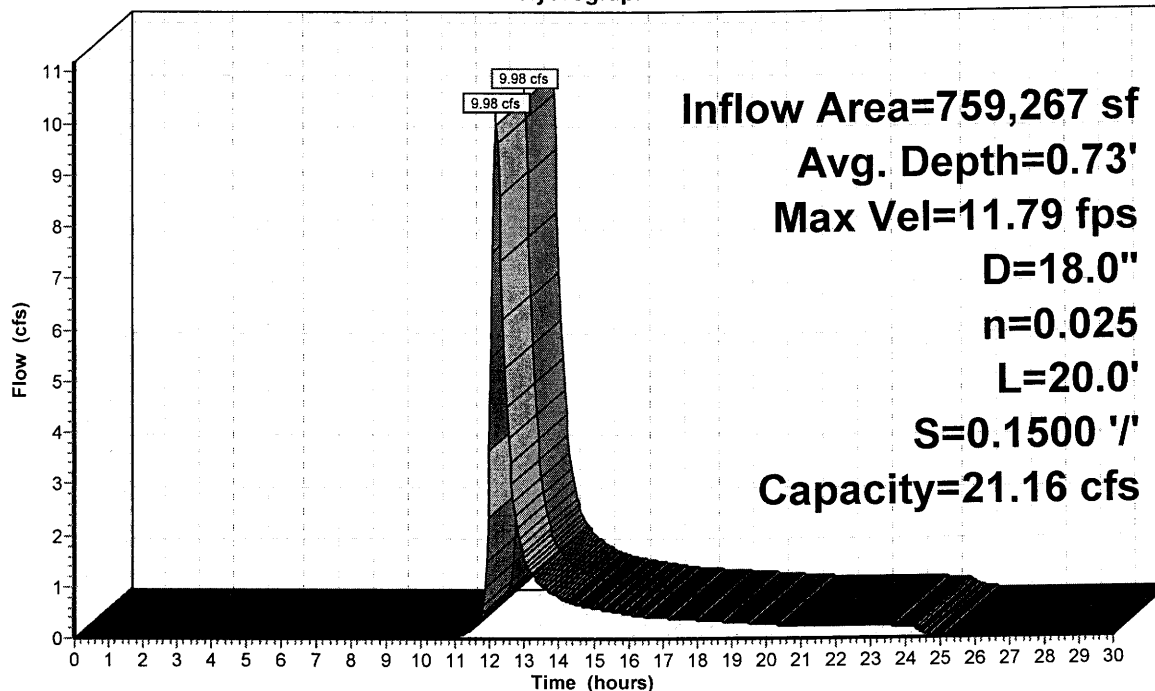
Length= 20.0' Slope= 0.1500 '/'

Inlet Invert= 5,505.00', Outlet Invert= 5,502.00'



## **Reach C7: Culvert C-7**

### **Hydrograph**



■ Inflow  
 □ Outflow

# **10yr-24hr East Pond**

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## **Summary for Reach E1DL: Lower E-1 Ditch**

[62] Warning: Exceeded Reach C2 OUTLET depth by 0.59' @ 12.30 hrs

[61] Hint: Exceeded Reach E1DU outlet invert by 0.73' @ 12.25 hrs

Inflow Area = 184,173 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 2.00 cfs @ 12.20 hrs, Volume= 8,968 cf  
 Outflow = 1.98 cfs @ 12.26 hrs, Volume= 8,968 cf, Atten= 1%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.50 fps, Min. Travel Time= 1.9 min

Avg. Velocity = 0.98 fps, Avg. Travel Time= 4.9 min

Peak Storage= 228 cf @ 12.23 hrs, Average Depth at Peak Storage= 0.73'

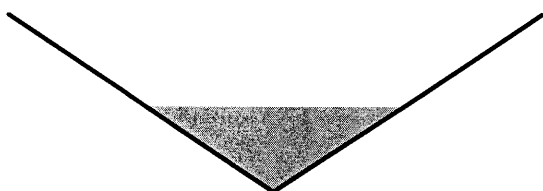
Bank-Full Depth= 1.50', Capacity at Bank-Full= 13.67 cfs

0.00' x 1.50' deep channel, n= 0.035

Side Slope Z-value= 1.5 '/' Top Width= 4.50'

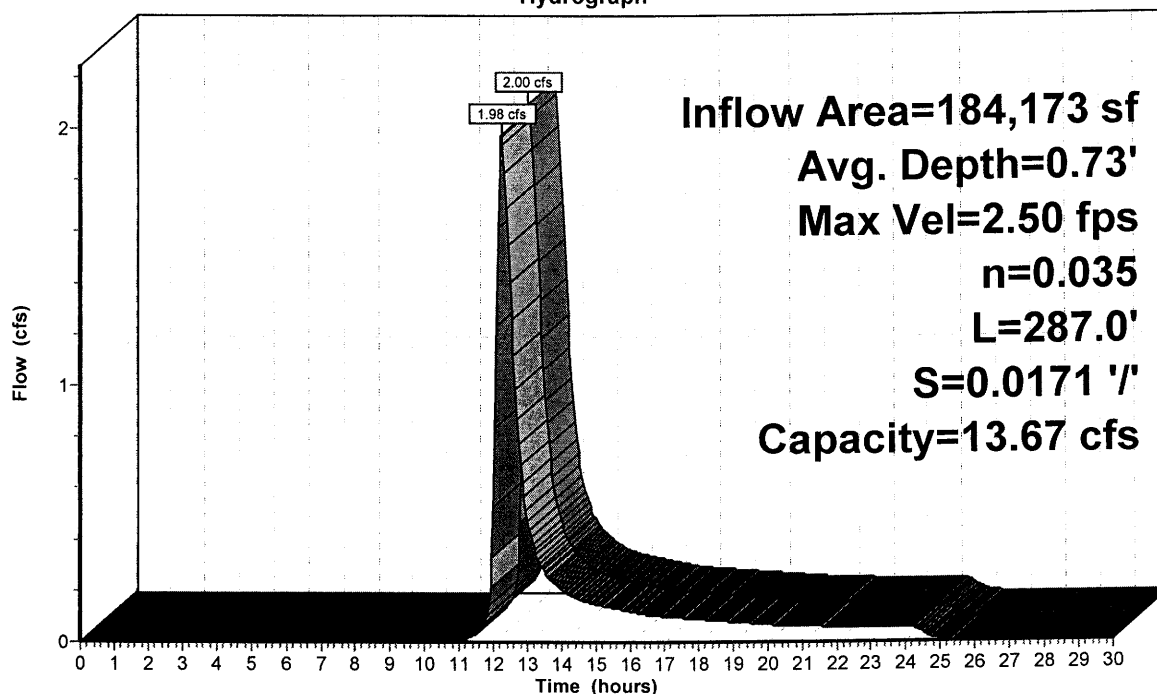
Length= 287.0' Slope= 0.0171 '/'

Inlet Invert= 5,508.70', Outlet Invert= 5,503.80'



## **Reach E1DL: Lower E-1 Ditch**

### **Hydrograph**



■ Inflow  
 ■ Outflow

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## **Summary for Reach E1DU: Upper E-1 Ditch**

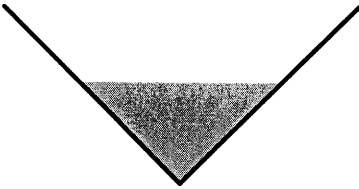
[62] Warning: Exceeded Reach C1 OUTLET depth by 0.65' @ 12.25 hrs

Inflow Area = 154,226 sf, 0.00% Impervious, Inflow Depth = 0.58"  
Inflow = 1.93 cfs @ 12.07 hrs, Volume= 7,510 cf  
Outflow = 1.73 cfs @ 12.24 hrs, Volume= 7,509 cf, Atten= 10%, Lag= 10.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Max. Velocity= 2.35 fps, Min. Travel Time= 5.1 min  
Avg. Velocity = 0.93 fps, Avg. Travel Time= 12.9 min

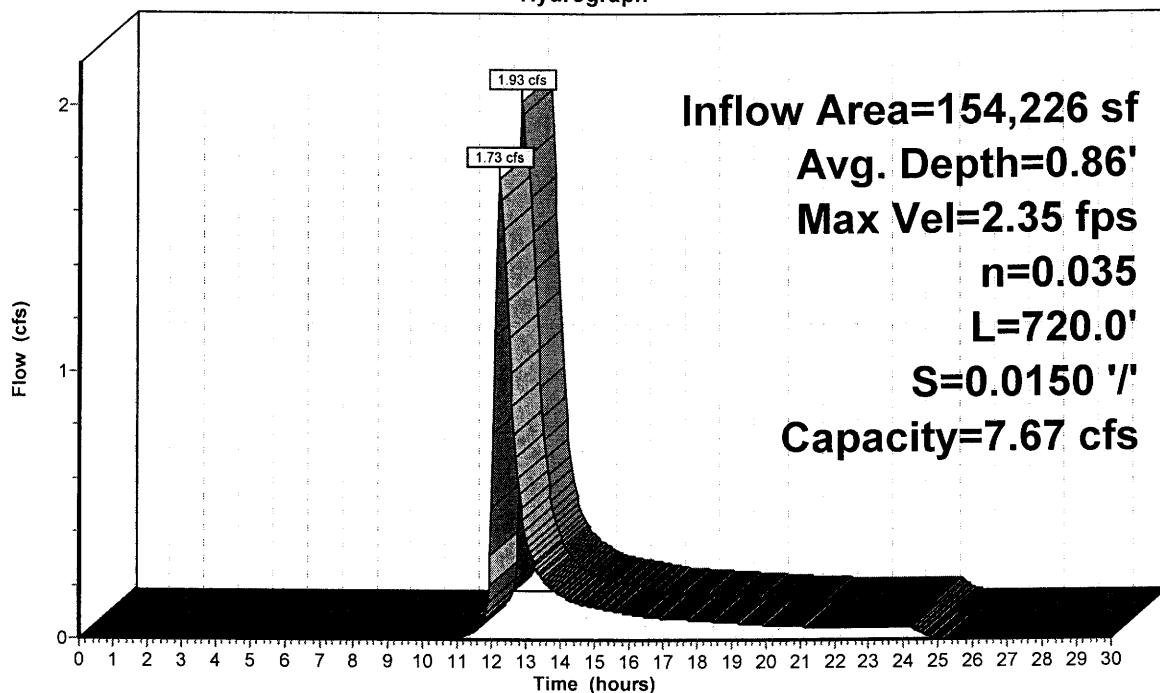
Peak Storage= 534 cf @ 12.15 hrs, Average Depth at Peak Storage= 0.86'  
Bank-Full Depth= 1.50', Capacity at Bank-Full= 7.67 cfs

0.00' x 1.50' deep channel, n= 0.035  
Side Slope Z-value= 1.0 '/' Top Width= 3.00'  
Length= 720.0' Slope= 0.0150 '/'  
Inlet Invert= 5,519.50', Outlet Invert= 5,508.70'



## **Reach E1DU: Upper E-1 Ditch**

Hydrograph



■ Inflow  
■ Outflow

# **10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach E3D: E-3 Ditch**

[62] Warning: Exceeded Reach C6 OUTLET depth by 0.08' @ 12.30 hrs

Inflow Area = 289,991 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 4.73 cfs @ 12.11 hrs, Volume= 14,120 cf  
 Outflow = 4.58 cfs @ 12.15 hrs, Volume= 14,120 cf, Atten= 3%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.17 fps, Min. Travel Time= 1.5 min

Avg. Velocity = 1.24 fps, Avg. Travel Time= 3.8 min

Peak Storage= 414 cf @ 12.13 hrs, Average Depth at Peak Storage= 0.78'

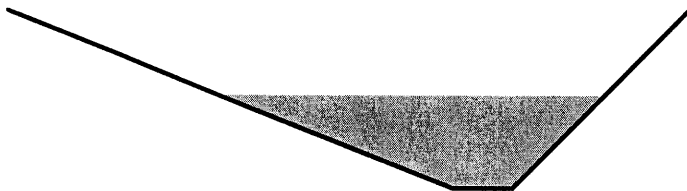
Bank-Full Depth= 1.50', Capacity at Bank-Full= 21.95 cfs

0.50' x 1.50' deep channel, n= 0.035

Side Slope Z-value= 2.5 1.0 '/' Top Width= 5.75'

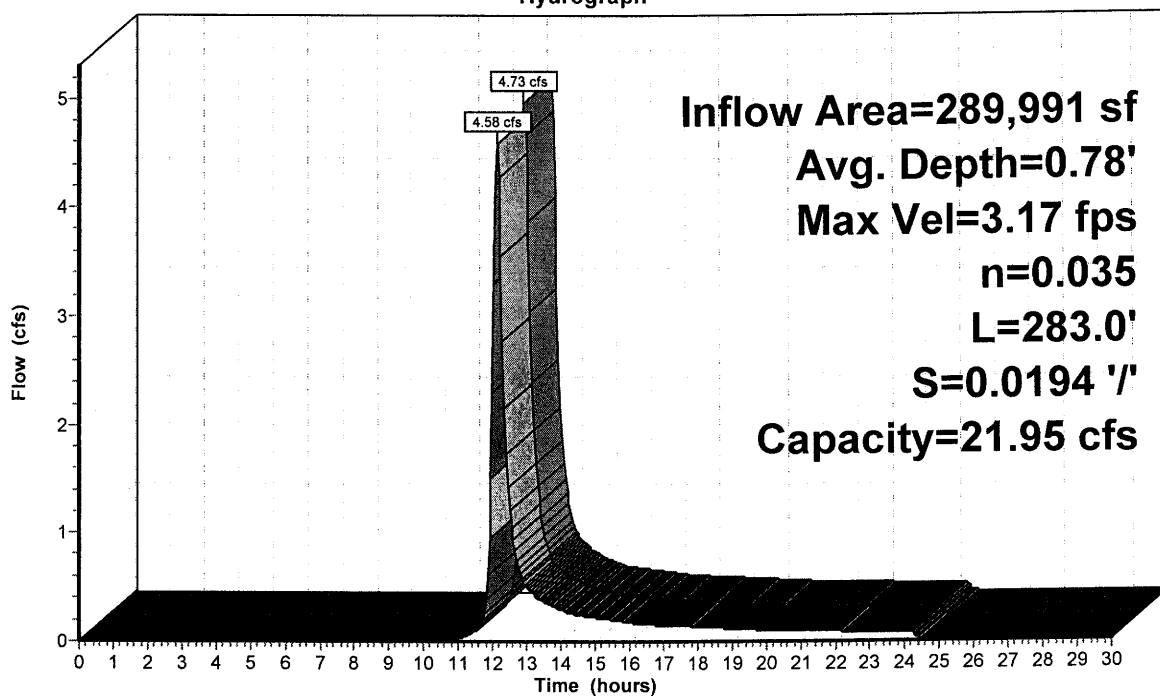
Length= 283.0' Slope= 0.0194 '/'

Inlet Invert= 5,509.50', Outlet Invert= 5,504.00'



## **Reach E3D: E-3 Ditch**

### **Hydrograph**



■ Inflow  
 ■ Outflow



# **10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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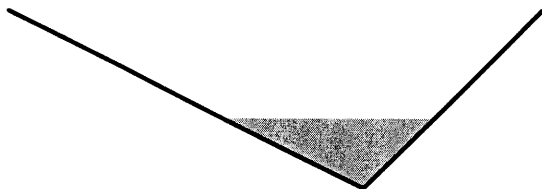
## **Summary for Reach E4D: E-4 Ditch**

Inflow Area = 29,947 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 0.78 cfs @ 11.94 hrs, Volume= 1,458 cf  
 Outflow = 0.59 cfs @ 12.08 hrs, Volume= 1,458 cf, Atten= 25%, Lag= 8.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 1.80 fps, Min. Travel Time= 5.2 min  
 Avg. Velocity= 0.65 fps, Avg. Travel Time= 14.4 min

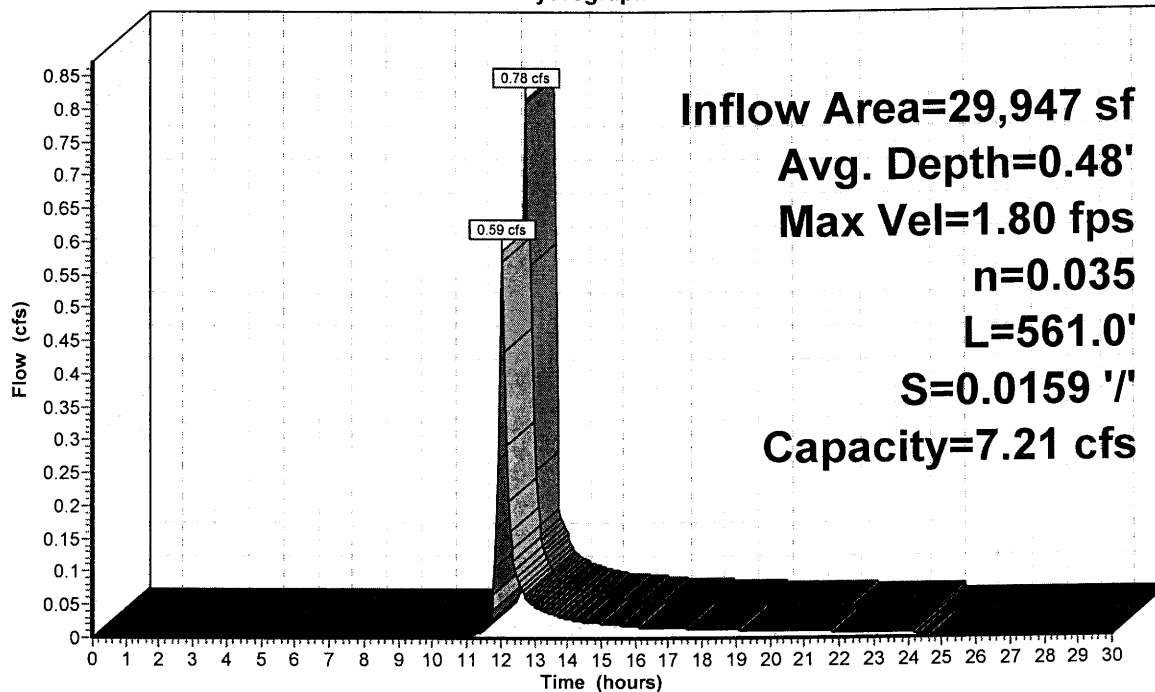
Peak Storage= 190 cf @ 11.99 hrs, Average Depth at Peak Storage= 0.48'  
 Bank-Full Depth= 1.20', Capacity at Bank-Full= 7.21 cfs

0.00' x 1.20' deep channel, n= 0.035  
 Side Slope Z-value= 2.0 1.0 ' / ' Top Width= 3.60'  
 Length= 561.0' Slope= 0.0159 ' / '  
 Inlet Invert= 5,518.70', Outlet Invert= 5,509.80'



## **Reach E4D: E-4 Ditch**

### **Hydrograph**



# **10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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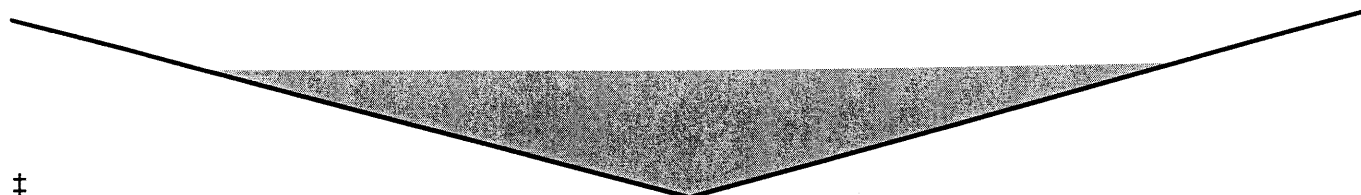
## **Summary for Reach E5D: E-5 Ditch**

Inflow Area = 285,103 sf, 0.00% Impervious, Inflow Depth = 0.58"  
Inflow = 4.82 cfs @ 12.08 hrs, Volume= 13,882 cf  
Outflow = 4.11 cfs @ 12.25 hrs, Volume= 13,882 cf, Atten= 15%, Lag= 10.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Max. Velocity= 2.00 fps, Min. Travel Time= 6.2 min  
Avg. Velocity = 0.69 fps, Avg. Travel Time= 17.9 min

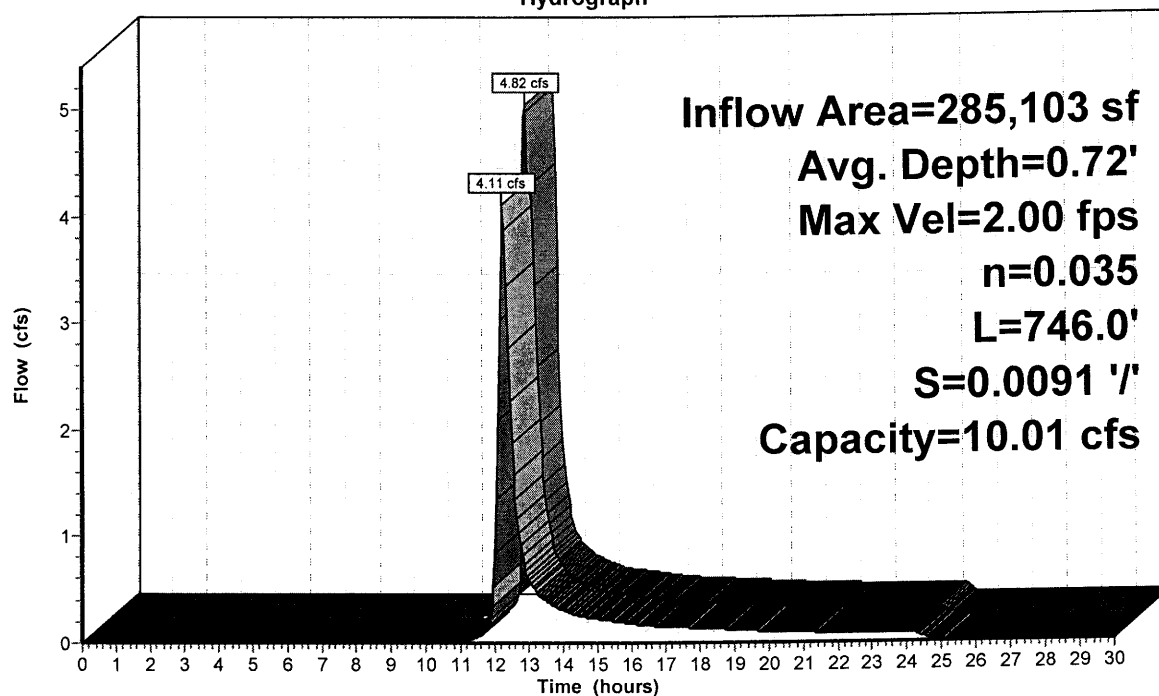
Peak Storage= 1,534 cf @ 12.15 hrs, Average Depth at Peak Storage= 0.72'  
Bank-Full Depth= 1.00', Capacity at Bank-Full= 10.01 cfs

0.00' x 1.00' deep channel, n= 0.035  
Side Slope Z-value= 4.0 '/' Top Width= 8.00'  
Length= 746.0' Slope= 0.0091 '/'  
Inlet Invert= 5,510.60', Outlet Invert= 5,503.80'



## **Reach E5D: E-5 Ditch**

### **Hydrograph**



**10yr-24hr East Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Pond EP: East Sed Pond**

Inflow Area = 759,267 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 9.98 cfs @ 12.21 hrs, Volume= 36,970 cf  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2  
 Peak Elev= 5,501.61' @ 30.00 hrs Surf.Area= 7,938 sf Storage= 36,970 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

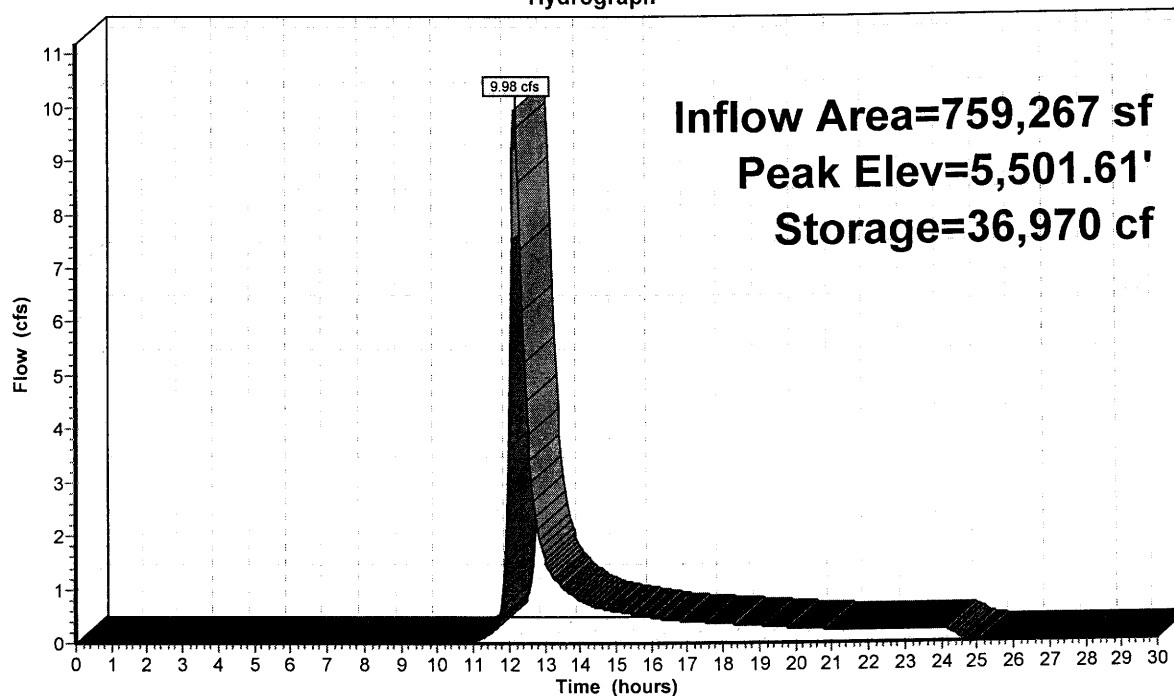
Center-of-Mass det. time= (not calculated: no outflow)

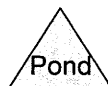
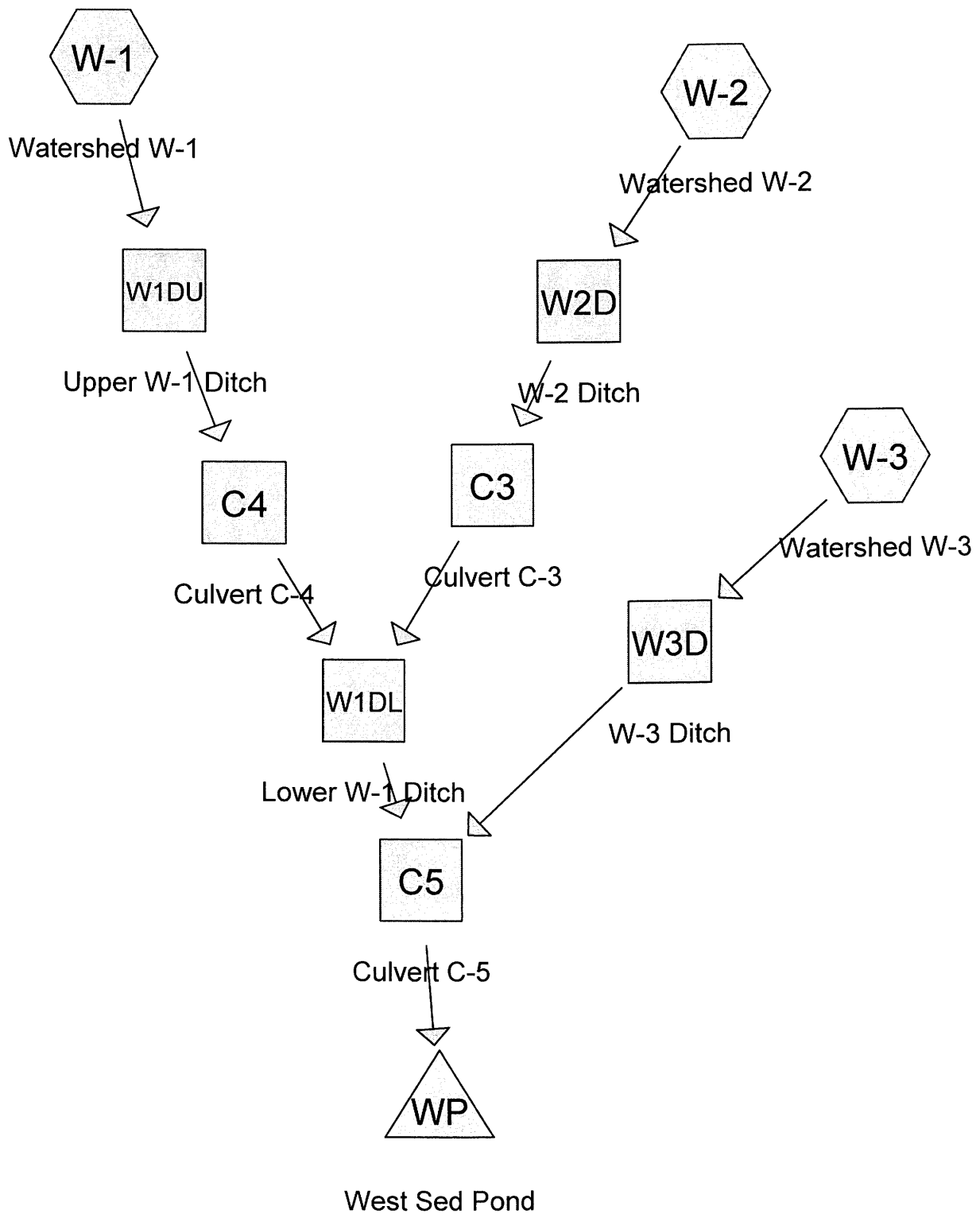
| Volume | Invert    | Avail.Storage | Storage Description  |
|--------|-----------|---------------|--|
| #1     | 5,493.80' | 56,820 cf     | <b>Custom Stage Data (Prismatic) Listed below (Recalc)</b> |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 5,493.80            | 2,550                | 0                         | 0                         |
| 5,494.80            | 2,601                | 2,576                     | 2,576                     |
| 5,495.80            | 3,214                | 2,908                     | 5,483                     |
| 5,496.80            | 3,909                | 3,562                     | 9,045                     |
| 5,497.80            | 4,637                | 4,273                     | 13,318                    |
| 5,498.80            | 5,425                | 5,031                     | 18,349                    |
| 5,499.80            | 6,243                | 5,834                     | 24,183                    |
| 5,500.80            | 7,158                | 6,701                     | 30,883                    |
| 5,501.80            | 8,125                | 7,642                     | 38,525                    |
| 5,502.80            | 9,087                | 8,606                     | 47,131                    |
| 5,503.80            | 10,291               | 9,689                     | 56,820                    |

**Pond EP: East Sed Pond**

Hydrograph





# **Drainage Diagram for 10yr-24hr West Pond**

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**10yr-24hr West Pond**

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**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN | Description<br>(subcatchment-numbers) |
|-----------------|----|---------------------------------------|
| <b>305,034</b>  | 87 | (W-1,W-2,W-3)                         |
| 305,034         |    | <b>TOTAL AREA</b>                     |

**10yr-24hr West Pond**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 0               | HSG A         |                         |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| <b>305,034</b>  | Other         | W-1, W-2, W-3           |
| 305,034         |               | <b>TOTAL AREA</b>       |

**10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment W-1: Watershed W-1** Runoff Area=105,474 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=1,297' Slope=0.0250 '/ Tc=19.5 min CN=87 Runoff=1.54 cfs 5,136 cf

**Subcatchment W-2: Watershed W-2** Runoff Area=128,724 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=635' Slope=0.0250 '/ Tc=11.0 min CN=87 Runoff=2.50 cfs 6,268 cf

**Subcatchment W-3: Watershed W-3** Runoff Area=70,836 sf 0.00% Impervious Runoff Depth=0.58"  
Flow Length=447' Slope=0.0270 '/ Tc=8.0 min CN=87 Runoff=1.55 cfs 3,449 cf

**Reach C3: Culvert C-3** Avg. Depth=0.43' Max Vel=5.28 fps Inflow=2.22 cfs 6,268 cf  
D=18.0" n=0.020 L=40.0' S=0.0325 '/ Capacity=12.31 cfs Outflow=2.21 cfs 6,268 cf

**Reach C4: Culvert C-4** Avg. Depth=0.46' Max Vel=2.83 fps Inflow=1.28 cfs 5,136 cf  
D=18.0" n=0.025 L=80.0' S=0.0138 '/ Capacity=6.41 cfs Outflow=1.28 cfs 5,136 cf

**Reach C5: Culvert C-5** Avg. Depth=0.36' Max Vel=9.32 fps Inflow=3.02 cfs 14,852 cf  
D=18.0" n=0.025 L=20.0' S=0.1950 '/ Capacity=24.12 cfs Outflow=3.02 cfs 14,852 cf

**Reach W1DL: Lower W-1 Ditch** Avg. Depth=0.82' Max Vel=2.02 fps Inflow=2.74 cfs 11,403 cf  
n=0.035 L=320.0' S=0.0088 '/ Capacity=29.49 cfs Outflow=2.68 cfs 11,403 cf

**Reach W1DU: Upper W-1 Ditch** Avg. Depth=0.56' Max Vel=2.04 fps Inflow=1.54 cfs 5,136 cf  
n=0.035 L=963.0' S=0.0145 '/ Capacity=38.02 cfs Outflow=1.28 cfs 5,136 cf

**Reach W2D: W-2 Ditch** Avg. Depth=0.26' Max Vel=1.99 fps Inflow=2.50 cfs 6,268 cf  
n=0.035 L=500.0' S=0.0158 '/ Capacity=23.56 cfs Outflow=2.22 cfs 6,268 cf

**Reach W3D: W-3 Ditch** Avg. Depth=0.52' Max Vel=2.02 fps Inflow=1.55 cfs 3,449 cf  
n=0.035 L=160.0' S=0.0156 '/ Capacity=8.65 cfs Outflow=1.45 cfs 3,449 cf

**Pond WP: West Sed Pond** Peak Elev=5,503.96' Storage=14,852 cf Inflow=3.02 cfs 14,852 cf  
Outflow=0.00 cfs 0 cf

**Total Runoff Area = 305,034 sf Runoff Volume = 14,853 cf Average Runoff Depth = 0.58"**  
**100.00% Pervious = 305,034 sf 0.00% Impervious = 0 sf**

**10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Subcatchment W-1: Watershed W-1**

Runoff = 1.54 cfs @ 12.13 hrs, Volume= 5,136 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

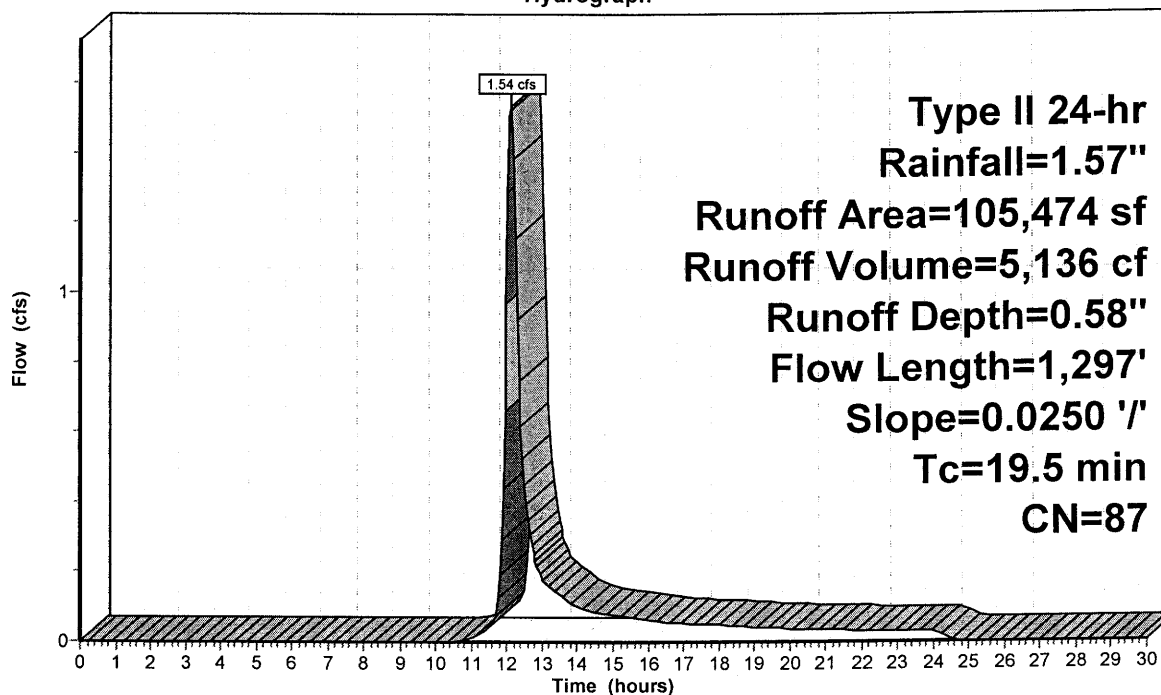
Type II 24-hr Rainfall=1.57"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 105,474 | 87 |               |
| 105,474   |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 19.5     | 1,297         | 0.0250        | 1.11              |                | Lag/CN Method, |

**Subcatchment W-1: Watershed W-1**

Hydrograph





**10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Subcatchment W-2: Watershed W-2**

Runoff = 2.50 cfs @ 12.04 hrs, Volume= 6,268 cf, Depth= 0.58"

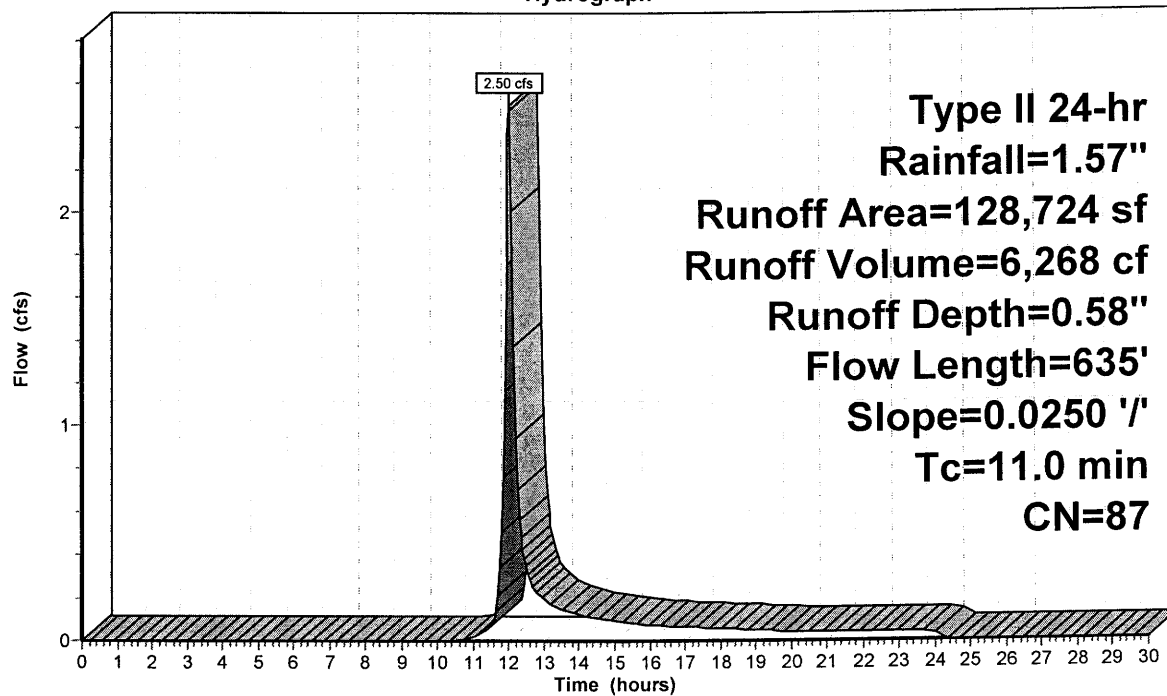
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=1.57"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 128,724   | 87 |               |
|   | 128,724   |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 11.0        | 635              | 0.0250           | 0.96                 |                   | Lag/CN Method, |

**Subcatchment W-2: Watershed W-2**

Hydrograph



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Type II 24-hr Rainfall=1.57"

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**Summary for Subcatchment W-3: Watershed W-3**

Runoff = 1.55 cfs @ 12.00 hrs, Volume= 3,449 cf, Depth= 0.58"

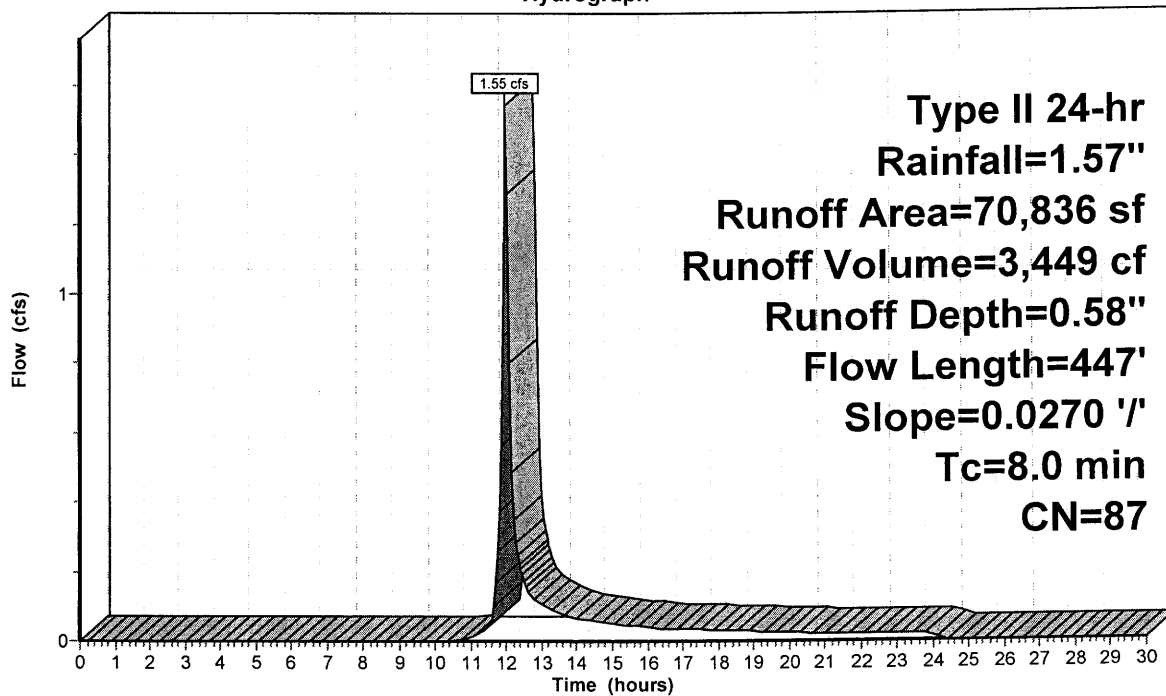
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=1.57"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 70,836  | 87 |               |
| 70,836    |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 8.0      | 447           | 0.0270        | 0.93              |                | Lag/CN Method, |

**Subcatchment W-3: Watershed W-3**

Hydrograph



# **10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach C3: Culvert C-3**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W2D OUTLET depth by 0.22' @ 12.20 hrs

Inflow Area = 128,724 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 2.22 cfs @ 12.15 hrs, Volume= 6,268 cf  
 Outflow = 2.21 cfs @ 12.15 hrs, Volume= 6,268 cf, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 5.28 fps, Min. Travel Time= 0.1 min

Avg. Velocity= 1.70 fps, Avg. Travel Time= 0.4 min

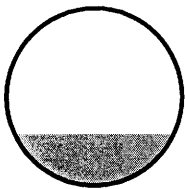
Peak Storage= 17 cf @ 12.15 hrs, Average Depth at Peak Storage= 0.43'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 12.31 cfs

18.0" Diameter Pipe, n= 0.020

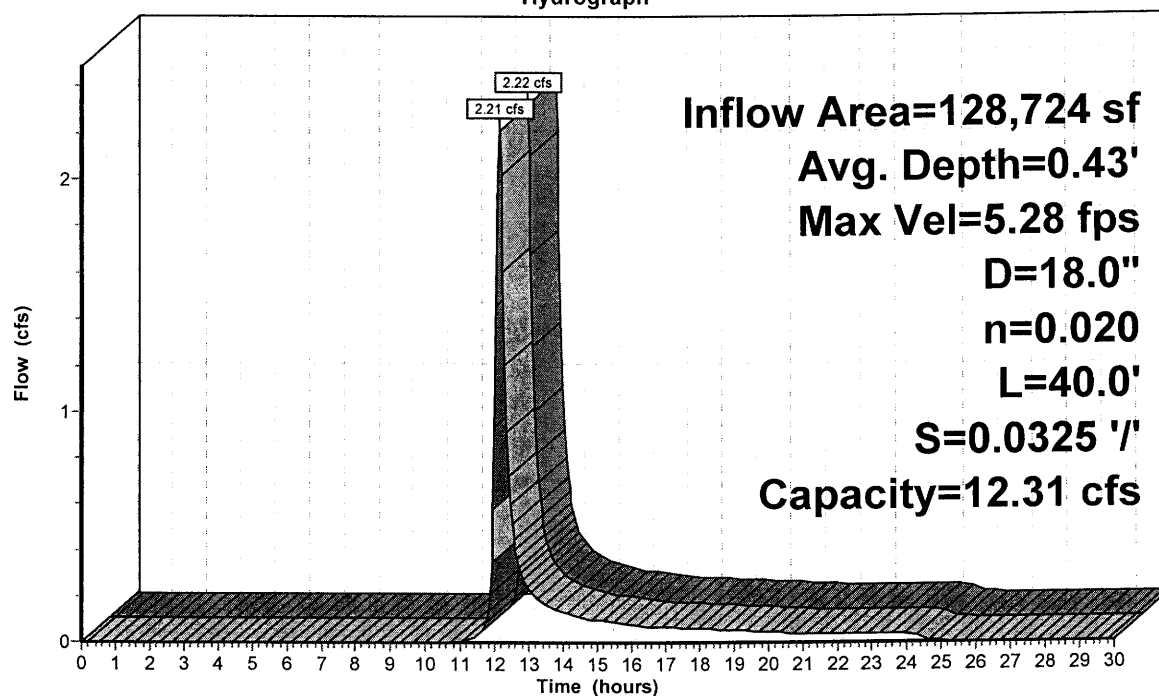
Length= 40.0' Slope= 0.0325 '/'

Inlet Invert= 5,512.10', Outlet Invert= 5,510.80'



## **Reach C3: Culvert C-3**

### **Hydrograph**



■ Inflow  
 ■ Outflow

# **10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach C4: Culvert C-4**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W1DU OUTLET depth by 1.20' @ 0.00 hrs

Inflow Area = 105,474 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 1.28 cfs @ 12.36 hrs, Volume= 5,136 cf  
 Outflow = 1.28 cfs @ 12.37 hrs, Volume= 5,136 cf, Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.83 fps, Min. Travel Time= 0.5 min

Avg. Velocity = 0.96 fps, Avg. Travel Time= 1.4 min

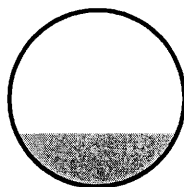
Peak Storage= 36 cf @ 12.36 hrs, Average Depth at Peak Storage= 0.46'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 6.41 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

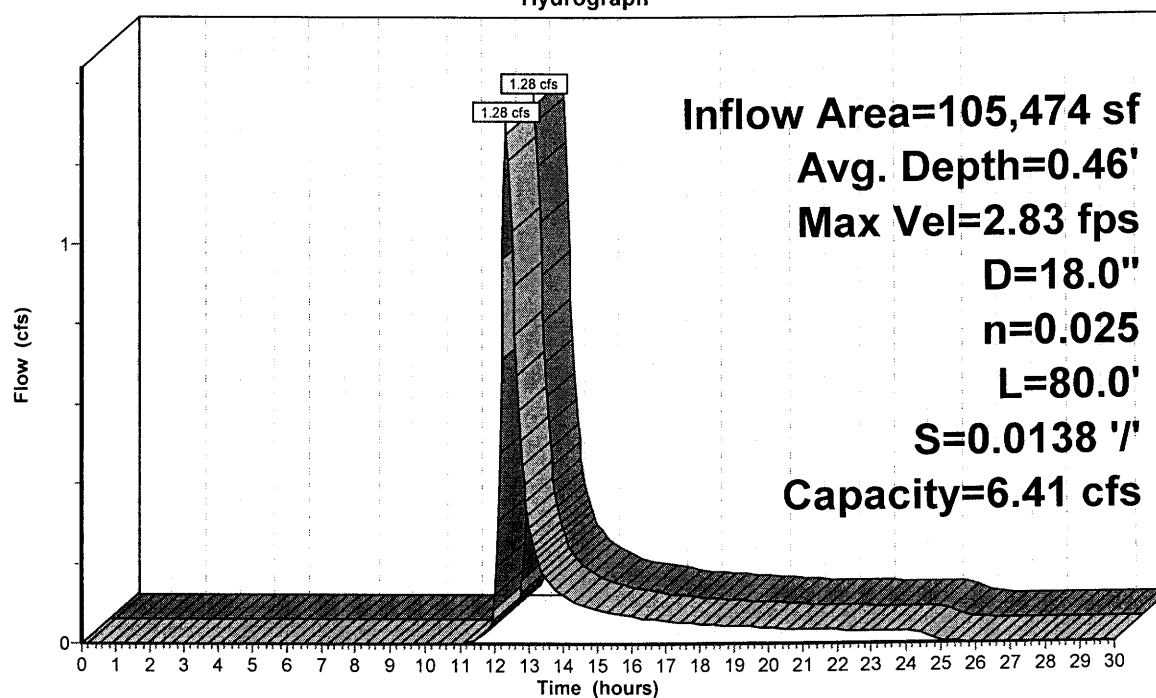
Length= 80.0' Slope= 0.0138 '/'

Inlet Invert= 5,512.00', Outlet Invert= 5,510.90'



## **Reach C4: Culvert C-4**

### **Hydrograph**



■ Inflow  
 □ Outflow

# **10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach C5: Culvert C-5**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W1DL OUTLET depth by 1.90' @ 10.55 hrs

[62] Warning: Exceeded Reach W3D OUTLET depth by 1.98' @ 12.30 hrs

Inflow Area = 305,034 sf, 0.00% Impervious, Inflow Depth = 0.58"

Inflow = 3.02 cfs @ 12.25 hrs, Volume= 14,852 cf

Outflow = 3.02 cfs @ 12.25 hrs, Volume= 14,852 cf, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 9.32 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 3.45 fps, Avg. Travel Time= 0.1 min

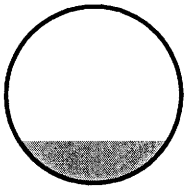
Peak Storage= 6 cf @ 12.25 hrs, Average Depth at Peak Storage= 0.36'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 24.12 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

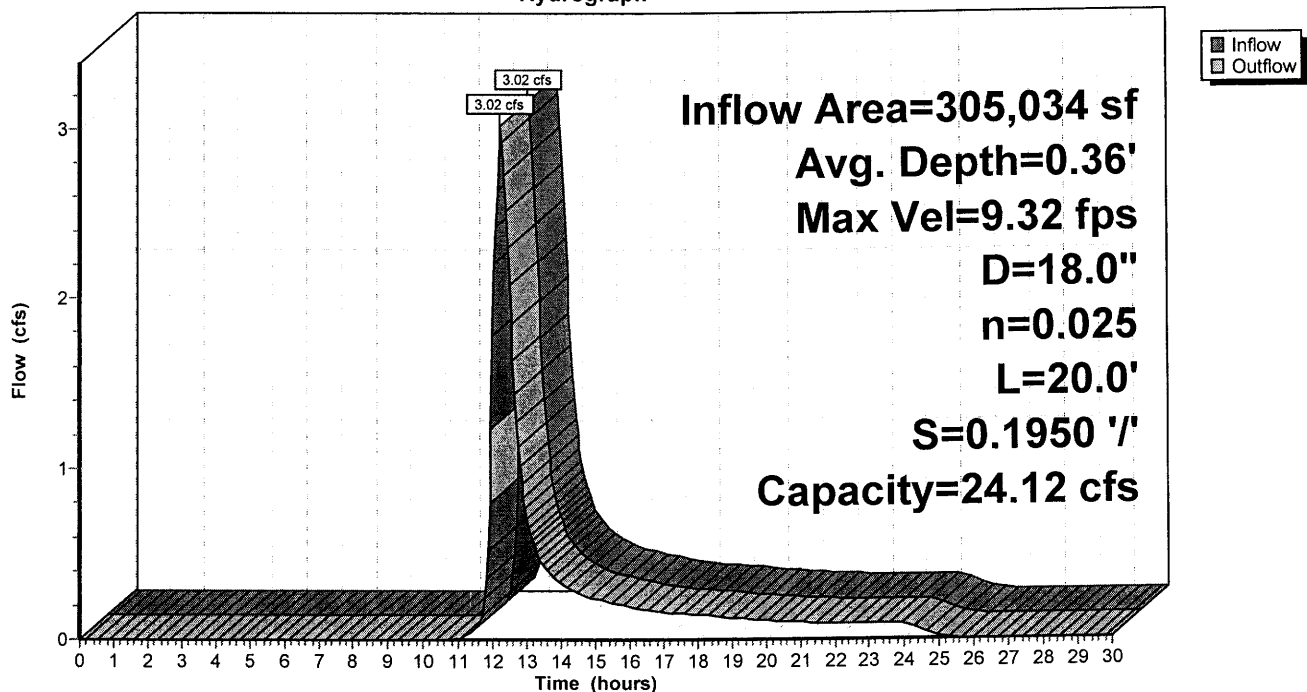
Length= 20.0' Slope= 0.1950 '/'

Inlet Invert= 5,509.90', Outlet Invert= 5,506.00'



## **Reach C5: Culvert C-5**

### **Hydrograph**



# **10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach W1DL: Lower W-1 Ditch**

[62] Warning: Exceeded Reach C3 OUTLET depth by 0.50' @ 12.40 hrs

[62] Warning: Exceeded Reach C4 OUTLET depth by 0.39' @ 12.15 hrs

Inflow Area = 234,198 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 2.74 cfs @ 12.18 hrs, Volume= 11,403 cf  
 Outflow = 2.68 cfs @ 12.27 hrs, Volume= 11,403 cf, Atten= 2%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.02 fps, Min. Travel Time= 2.6 min

Avg. Velocity = 0.76 fps, Avg. Travel Time= 7.0 min

Peak Storage= 426 cf @ 12.22 hrs, Average Depth at Peak Storage= 0.82'

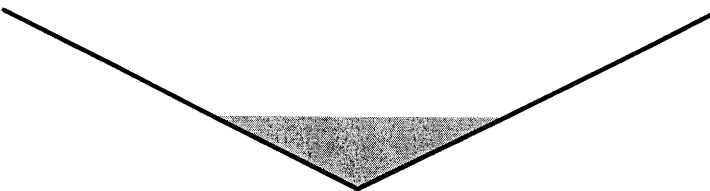
Bank-Full Depth= 2.00', Capacity at Bank-Full= 29.49 cfs

0.00' x 2.00' deep channel, n= 0.035

Side Slope Z-value= 2.0 '/' Top Width= 8.00'

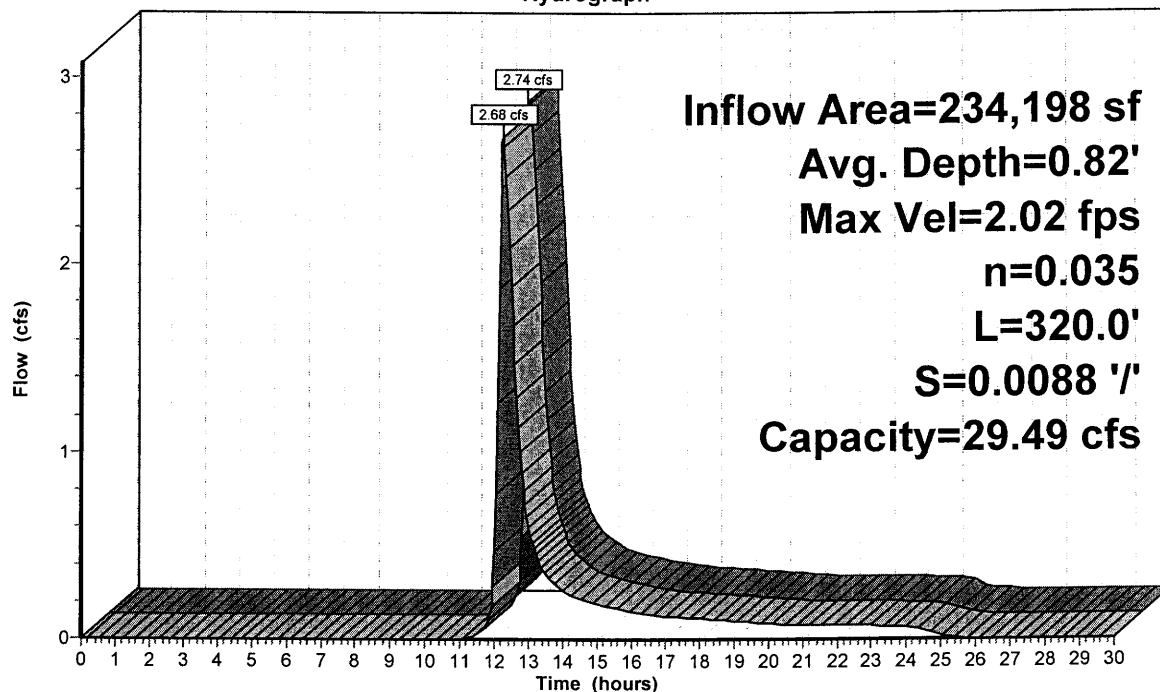
Length= 320.0' Slope= 0.0088 '/'

Inlet Invert= 5,510.80', Outlet Invert= 5,508.00'



## **Reach W1DL: Lower W-1 Ditch**

Hydrograph



■ Inflow  
 ■ Outflow

**10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Reach W1DU: Upper W-1 Ditch**

Inflow Area = 105,474 sf, 0.00% Impervious, Inflow Depth = 0.58"  
Inflow = 1.54 cfs @ 12.13 hrs, Volume= 5,136 cf  
Outflow = 1.28 cfs @ 12.36 hrs, Volume= 5,136 cf, Atten= 17%, Lag= 13.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.04 fps, Min. Travel Time= 7.9 min

Avg. Velocity = 0.78 fps, Avg. Travel Time= 20.6 min

Peak Storage= 612 cf @ 12.22 hrs, Average Depth at Peak Storage= 0.56'

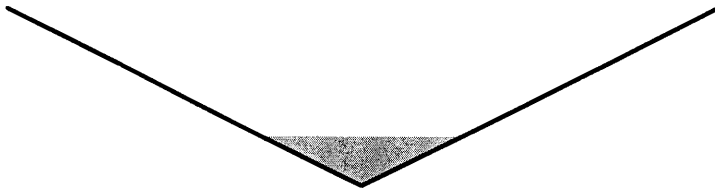
Bank-Full Depth= 2.00', Capacity at Bank-Full= 38.02 cfs

0.00' x 2.00' deep channel, n= 0.035

Side Slope Z-value= 2.0 '/' Top Width= 8.00'

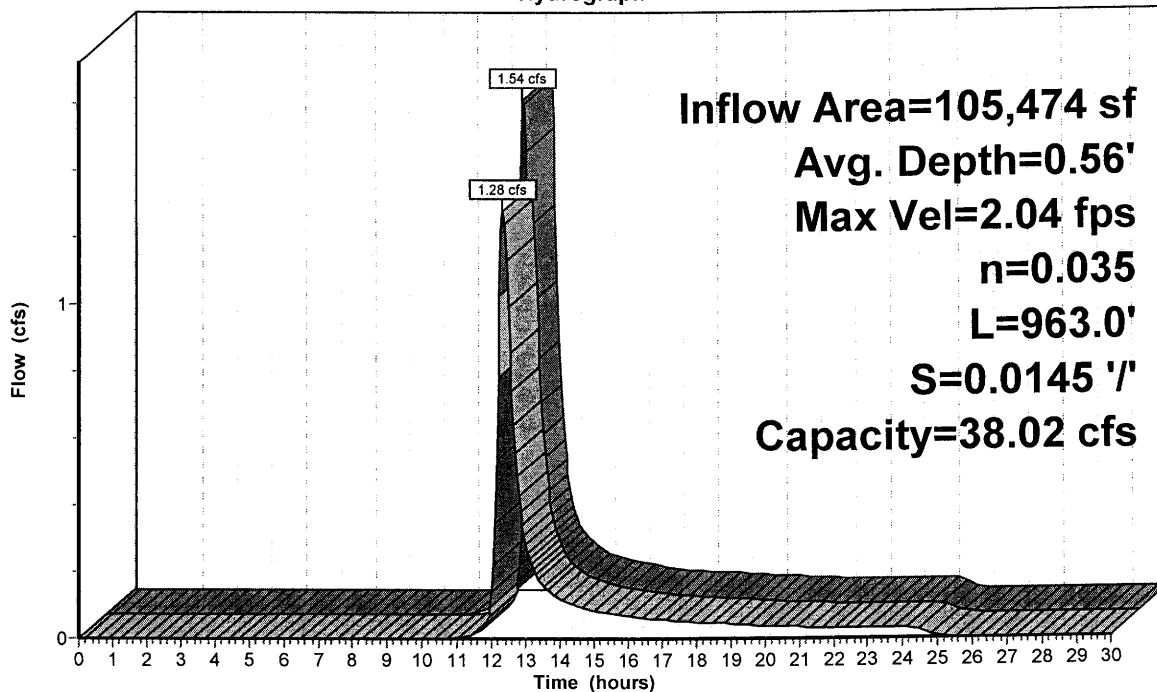
Length= 963.0' Slope= 0.0145 '/'

Inlet Invert= 5,524.80', Outlet Invert= 5,510.80'



**Reach W1DU: Upper W-1 Ditch**

Hydrograph



# **10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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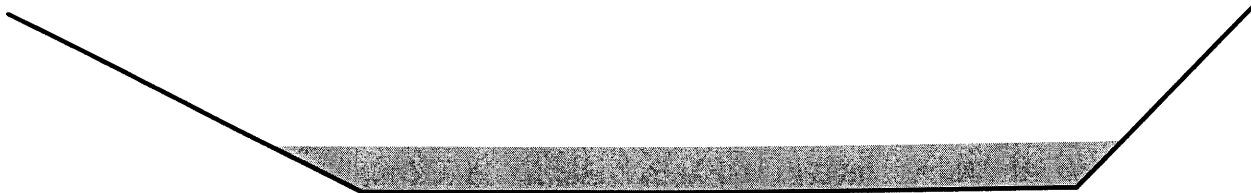
## **Summary for Reach W2D: W-2 Ditch**

Inflow Area = 128,724 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 2.50 cfs @ 12.04 hrs, Volume= 6,268 cf  
 Outflow = 2.22 cfs @ 12.15 hrs, Volume= 6,268 cf, Atten= 11%, Lag= 6.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 1.99 fps, Min. Travel Time= 4.2 min  
 Avg. Velocity= 0.50 fps, Avg. Travel Time= 16.7 min

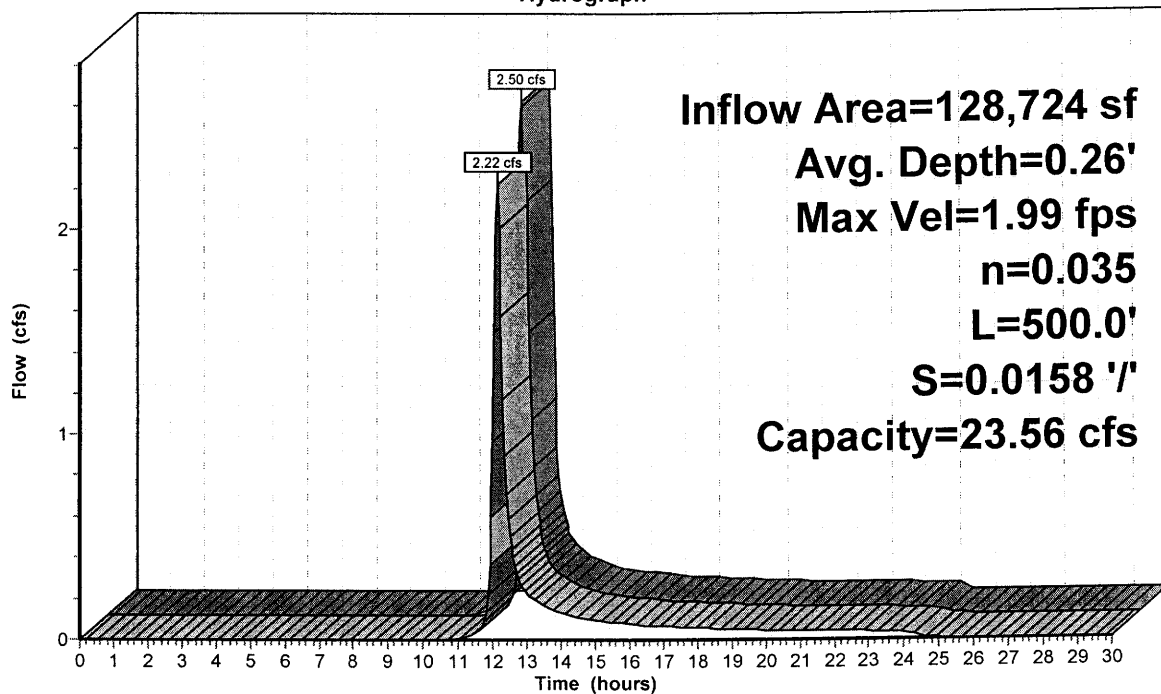
Peak Storage= 568 cf @ 12.08 hrs, Average Depth at Peak Storage= 0.26'  
 Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.56 cfs

4.00' x 1.00' deep channel, n= 0.035  
 Side Slope Z-value= 2.0 1.0 '/' Top Width= 7.00'  
 Length= 500.0' Slope= 0.0158 '/'  
 Inlet Invert= 5,520.00', Outlet Invert= 5,512.10'



## **Reach W2D: W-2 Ditch**

### **Hydrograph**



■ Inflow  
 ■ Outflow



# **10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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## **Summary for Reach W3D: W-3 Ditch**

Inflow Area = 70,836 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 1.55 cfs @ 12.00 hrs, Volume= 3,449 cf  
 Outflow = 1.45 cfs @ 12.04 hrs, Volume= 3,449 cf, Atten= 6%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.02 fps, Min. Travel Time= 1.3 min

Avg. Velocity = 0.78 fps, Avg. Travel Time= 3.4 min

Peak Storage= 118 cf @ 12.02 hrs, Average Depth at Peak Storage= 0.52'

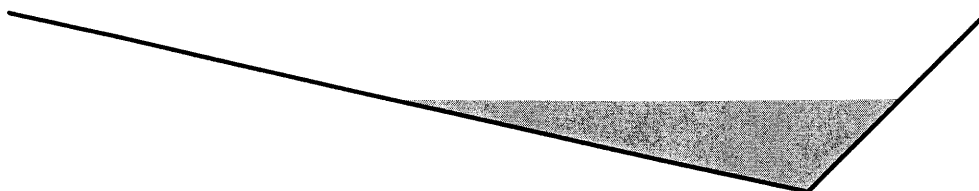
Bank-Full Depth= 1.00', Capacity at Bank-Full= 8.65 cfs

0.00' x 1.00' deep channel, n= 0.035

Side Slope Z-value= 4.5 1.0 '/' Top Width= 5.50'

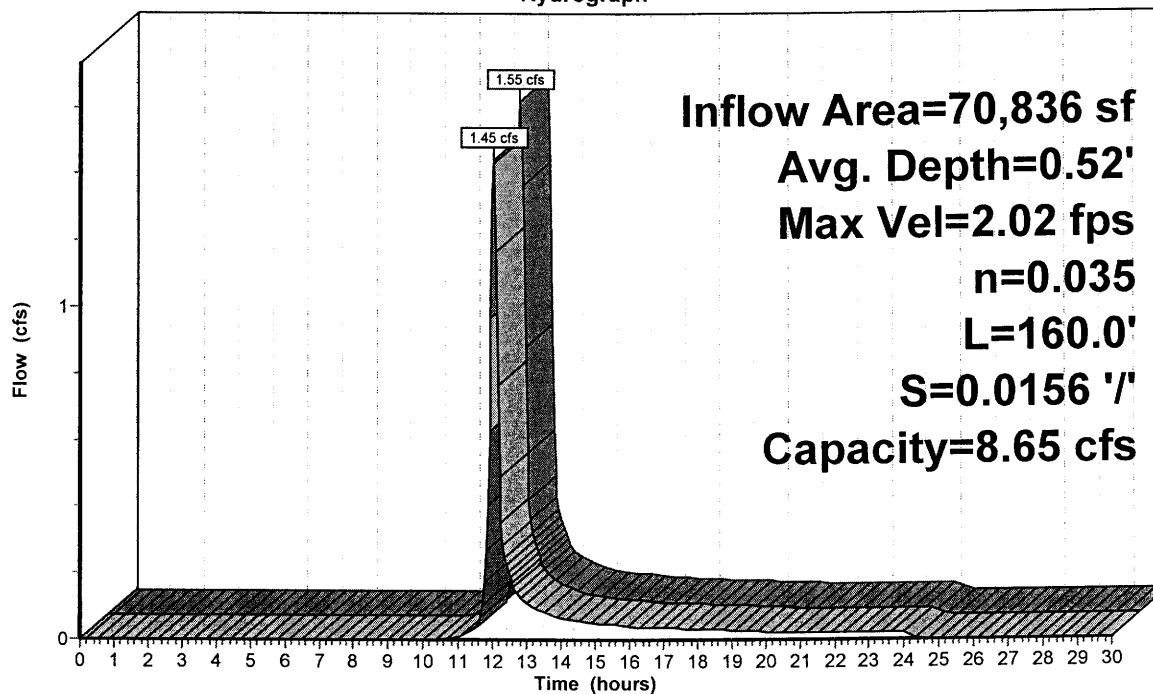
Length= 160.0' Slope= 0.0156 '/'

Inlet Invert= 5,510.50', Outlet Invert= 5,508.00'



## **Reach W3D: W-3 Ditch**

### **Hydrograph**



■ Inflow  
 ■ Outflow

**10yr-24hr West Pond**

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Type II 24-hr Rainfall=1.57"

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**Summary for Pond WP: West Sed Pond**

Inflow Area = 305,034 sf, 0.00% Impervious, Inflow Depth = 0.58"  
 Inflow = 3.02 cfs @ 12.25 hrs, Volume= 14,852 cf  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Peak Elev= 5,503.96' @ 30.00 hrs Surf.Area= 4,030 sf Storage= 14,852 cf

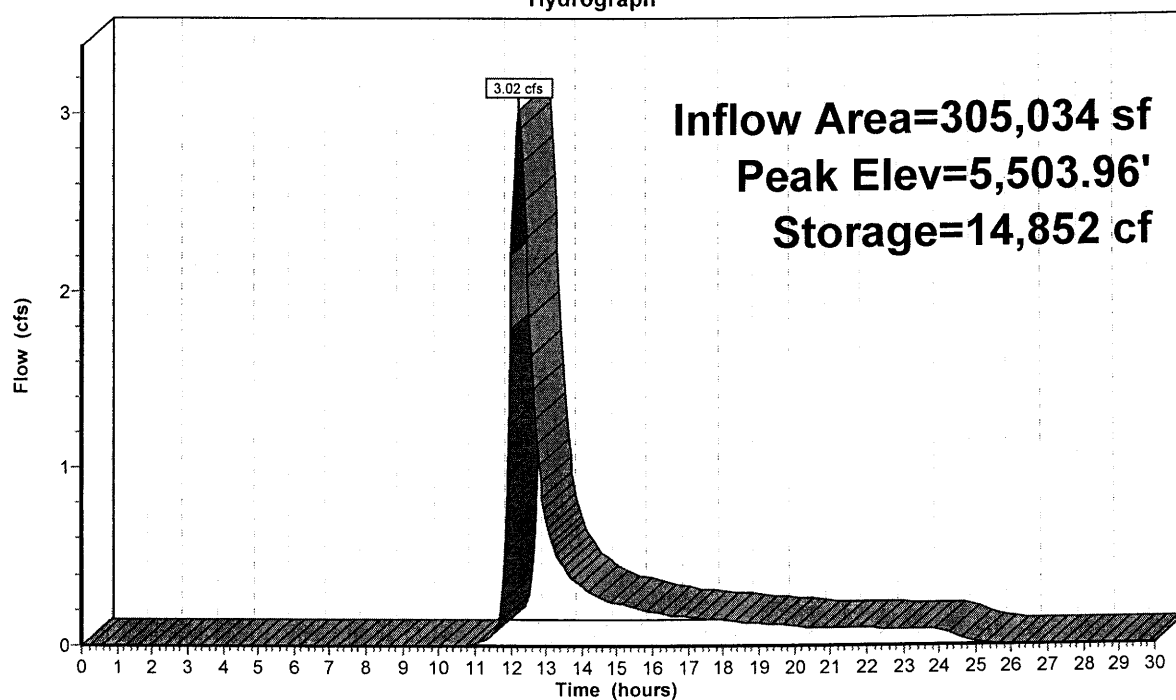
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

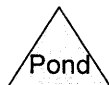
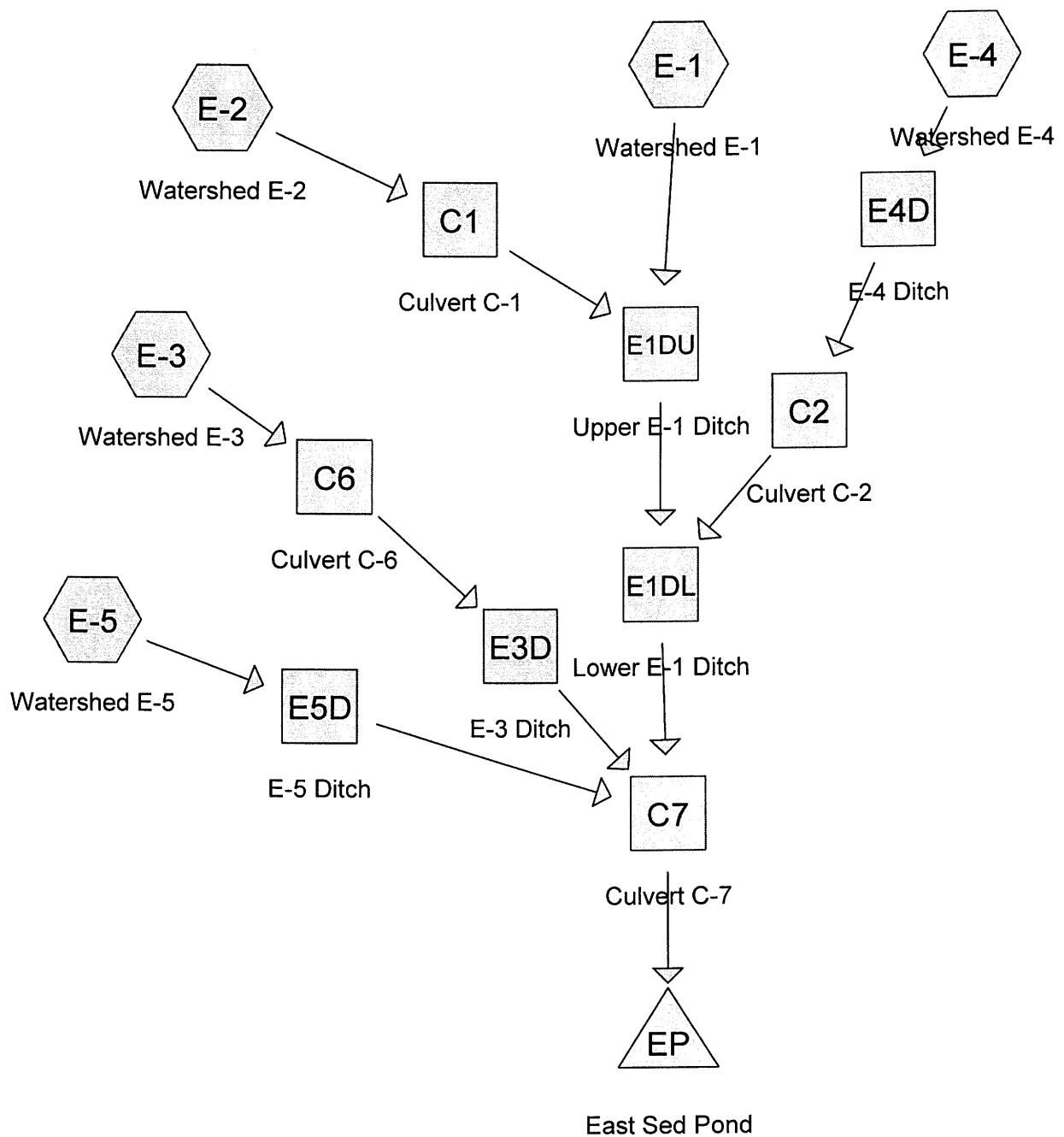
Center-of-Mass det. time= (not calculated: no outflow)

| Volume | Invert    | Avail.Storage | Storage Description                        |
|--------|-----------|---------------|--|
| #1     | 5,498.23' | 36,065 cf     | 17.00'W x 78.00'L x 9.77'H Prismatic Z=2.0 |

**Pond WP: West Sed Pond**

Hydrograph





**25yr-6hr East Pond**

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**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN | Description<br>(subcatchment-numbers) |
|-----------------|----|---------------------------------------|
| <b>759,267</b>  | 87 | (E-1,E-2,E-3,E-4,E-5)                 |
| 759,267         |    | <b>TOTAL AREA</b>                     |

**25yr-6hr East Pond**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 0               | HSG A         |                         |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| <b>759,267</b>  | Other         | E-1, E-2, E-3, E-4, E-5 |
| 759,267         |               | <b>TOTAL AREA</b>       |

**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E-1: Watershed E-1** Runoff Area=88,103 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=1,752' Slope=0.0210 '/' Tc=27.1 min CN=87 Runoff=0.98 cfs 2,902 cf

**Subcatchment E-2: Watershed E-2** Runoff Area=66,123 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=581' Slope=0.0210 '/' Tc=11.2 min CN=87 Runoff=1.42 cfs 2,178 cf

**Subcatchment E-3: Watershed E-3** Runoff Area=289,991 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=1,091' Slope=0.0300 '/' Tc=15.5 min CN=87 Runoff=4.88 cfs 9,552 cf

**Subcatchment E-4: Watershed E-4** Runoff Area=29,947 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=561' Slope=0.2500 '/' Tc=3.2 min CN=87 Runoff=1.16 cfs 986 cf

**Subcatchment E-5: Watershed E-5** Runoff Area=285,103 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=925' Slope=0.0250 '/' Tc=14.9 min CN=87 Runoff=4.98 cfs 9,391 cf

**Reach C1: Culvert C-1** Avg. Depth=0.35' Max Vel=4.46 fps Inflow=1.42 cfs 2,178 cf  
D=18.0" n=0.020 L=40.0' S=0.0300 '/' Capacity=11.83 cfs Outflow=1.40 cfs 2,178 cf

**Reach C2: Culvert C-2** Avg. Depth=0.24' Max Vel=3.45 fps Inflow=0.65 cfs 986 cf  
D=18.0" n=0.020 L=40.0' S=0.0275 '/' Capacity=11.32 cfs Outflow=0.63 cfs 988 cf

**Reach C6: Culvert C-6** Avg. Depth=0.83' Max Vel=4.83 fps Inflow=4.88 cfs 9,552 cf  
D=18.0" n=0.025 L=200.0' S=0.0225 '/' Capacity=8.19 cfs Outflow=4.80 cfs 9,552 cf

**Reach C7: Culvert C-7** Avg. Depth=0.69' Max Vel=11.54 fps Inflow=9.25 cfs 25,010 cf  
D=18.0" n=0.025 L=20.0' S=0.1500 '/' Capacity=21.16 cfs Outflow=9.24 cfs 25,010 cf

**Reach E1DL: Lower E-1 Ditch** Avg. Depth=0.69' Max Vel=2.42 fps Inflow=1.75 cfs 6,068 cf  
n=0.035 L=287.0' S=0.0171 '/' Capacity=13.67 cfs Outflow=1.74 cfs 6,068 cf

**Reach E1DU: Upper E-1 Ditch** Avg. Depth=0.82' Max Vel=2.28 fps Inflow=1.75 cfs 5,080 cf  
n=0.035 L=720.0' S=0.0150 '/' Capacity=7.67 cfs Outflow=1.53 cfs 5,080 cf

**Reach E3D: E-3 Ditch** Avg. Depth=0.79' Max Vel=3.18 fps Inflow=4.80 cfs 9,552 cf  
n=0.035 L=283.0' S=0.0194 '/' Capacity=21.95 cfs Outflow=4.62 cfs 9,552 cf

**Reach E4D: E-4 Ditch** Avg. Depth=0.50' Max Vel=1.83 fps Inflow=1.16 cfs 986 cf  
n=0.035 L=561.0' S=0.0159 '/' Capacity=7.21 cfs Outflow=0.65 cfs 986 cf

**Reach E5D: E-5 Ditch** Avg. Depth=0.70' Max Vel=1.98 fps Inflow=4.98 cfs 9,391 cf  
n=0.035 L=746.0' S=0.0091 '/' Capacity=10.01 cfs Outflow=3.89 cfs 9,391 cf

**Pond EP: East Sed Pond** Peak Elev=5,504.26' Storage=61,684 cf Inflow=9.24 cfs 25,010 cf  
Outflow=2.26 cfs 18,184 cf

**Total Runoff Area = 759,267 sf Runoff Volume = 25,009 cf Average Runoff Depth = 0.40"**  
**100.00% Pervious = 759,267 sf 0.00% Impervious = 0 sf**

**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment E-1: Watershed E-1**

Runoff = 0.98 cfs @ 3.34 hrs, Volume= 2,902 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

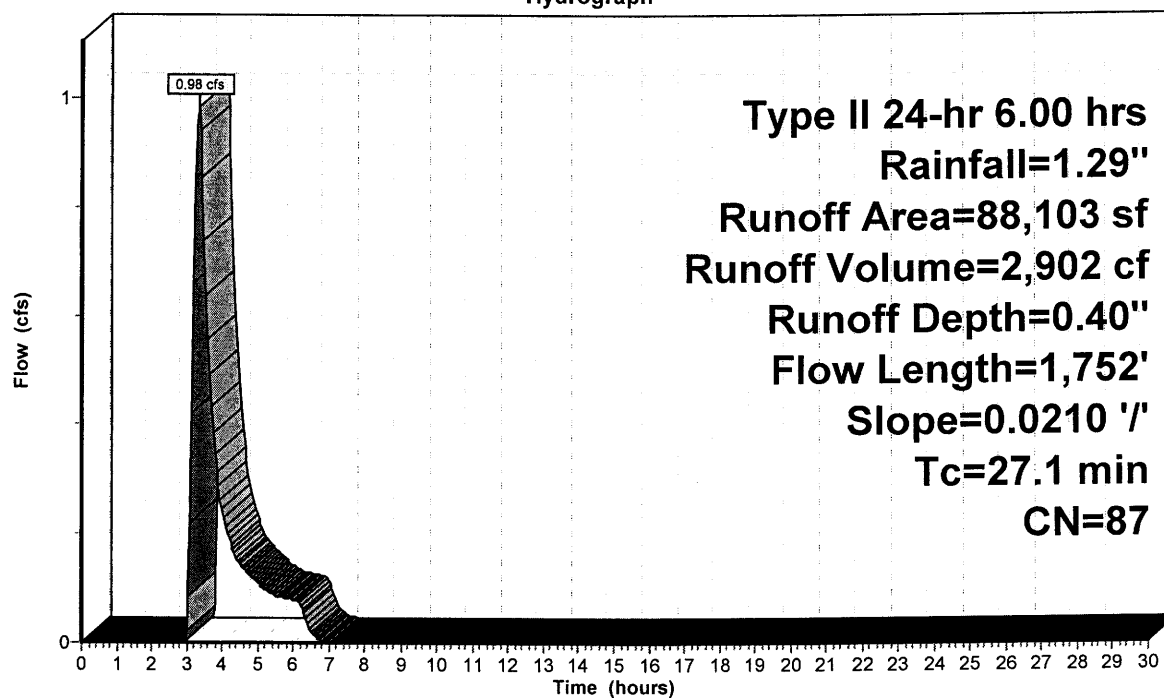
Type II 24-hr 6.00 hrs Rainfall=1.29"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 88,103    | 87 |               |
|   | 88,103    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 27.1        | 1,752            | 0.0210           | 1.08                 |                   | Lag/CN Method, |

**Subcatchment E-1: Watershed E-1**

Hydrograph



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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment E-2: Watershed E-2**

Runoff = 1.42 cfs @ 3.12 hrs, Volume= 2,178 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type II 24-hr 6.00 hrs Rainfall=1.29"

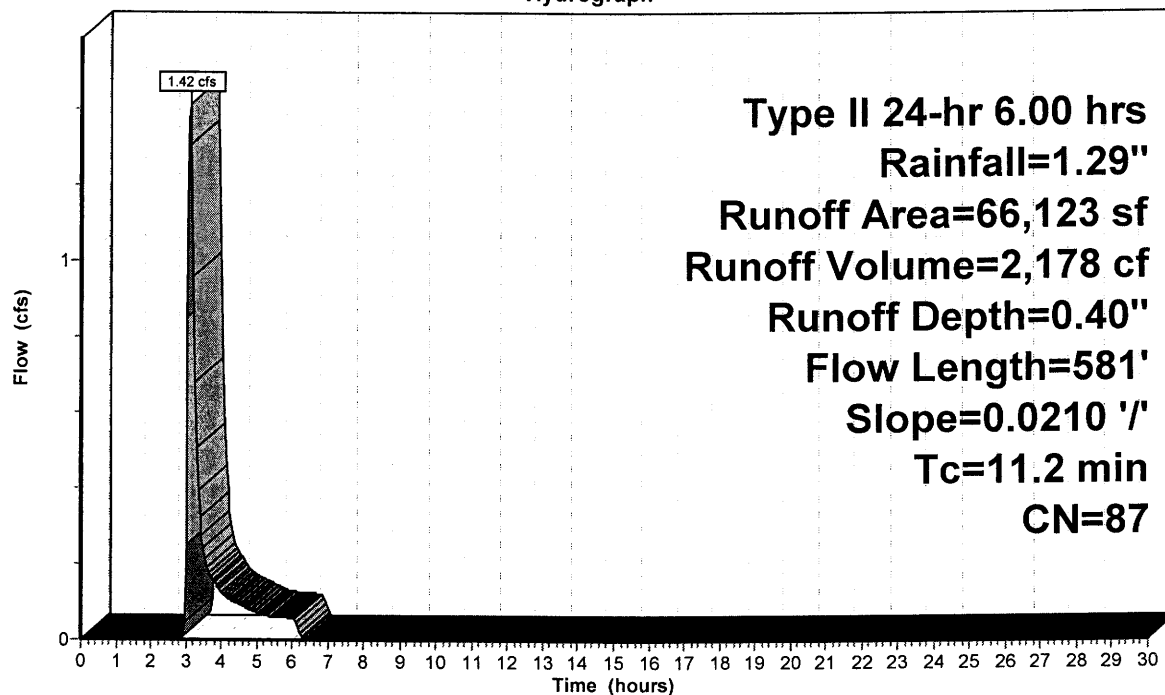
|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 66,123    | 87 |               |
|   | 66,123    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 11.2        | 581              | 0.0210           | 0.86                 |                   | Lag/CN Method, |

**Subcatchment E-2: Watershed E-2**

Hydrograph



Runoff



**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment E-3: Watershed E-3**

Runoff = 4.88 cfs @ 3.18 hrs, Volume= 9,552 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

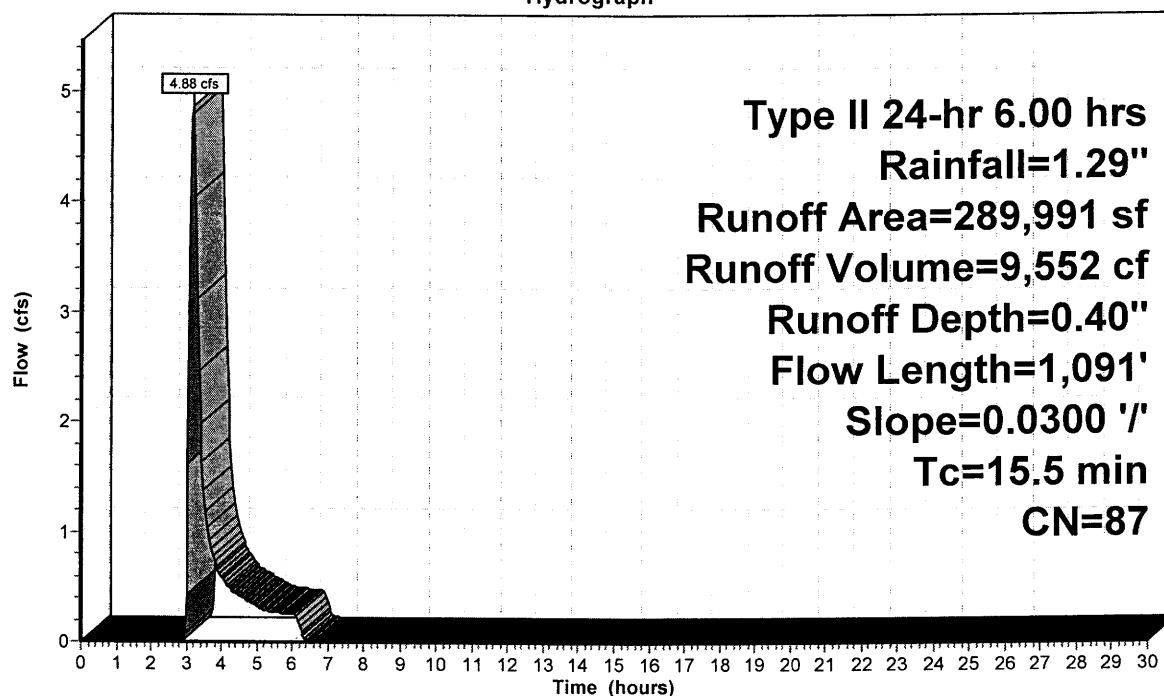
Type II 24-hr 6.00 hrs Rainfall=1.29"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 289,991 | 87 |               |
| 289,991   |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 15.5     | 1,091         | 0.0300        | 1.17              |                | Lag/CN Method, |

**Subcatchment E-3: Watershed E-3**

Hydrograph



**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment E-4: Watershed E-4**[49] Hint:  $T_c < 2dt$  may require smaller  $dt$ 

Runoff = 1.16 cfs @ 3.01 hrs, Volume= 986 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs,  $dt=0.05$  hrs

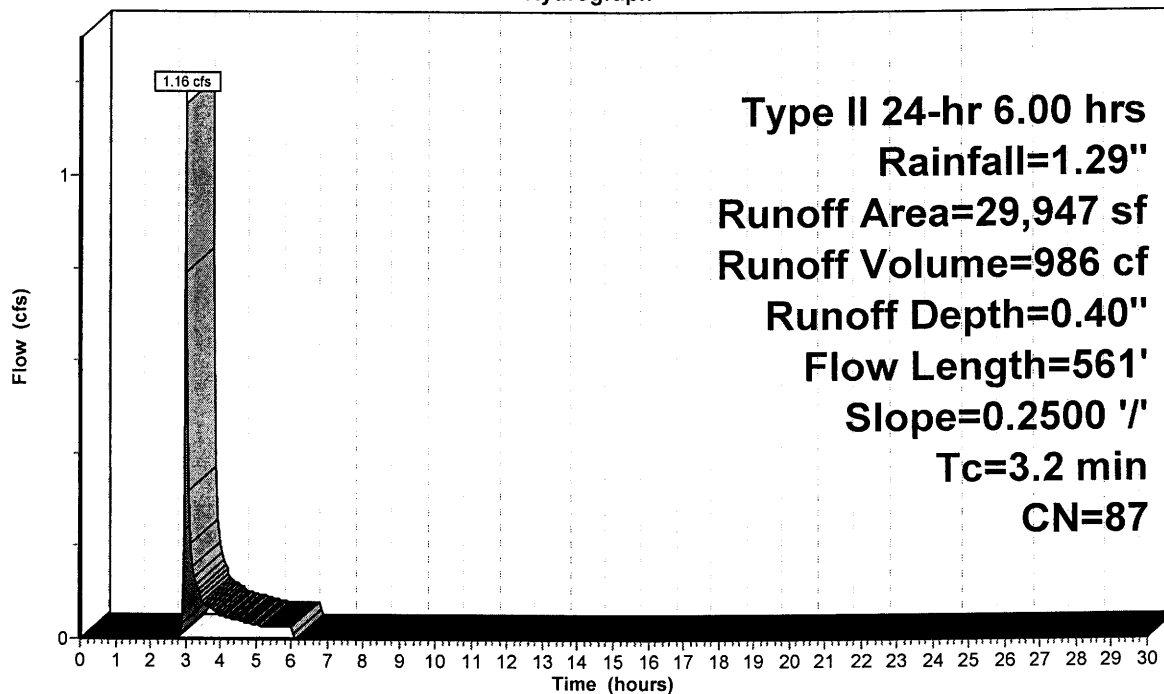
Type II 24-hr 6.00 hrs Rainfall=1.29"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 29,947    | 87 |               |
|   | 29,947    |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 3.2      | 561           | 0.2500        | 2.96              |                | Lag/CN Method, |

**Subcatchment E-4: Watershed E-4**

Hydrograph



### Summary for Subcatchment E-5: Watershed E-5

Runoff = 4.98 cfs @ 3.17 hrs, Volume= 9,391 cf, Depth= 0.40"

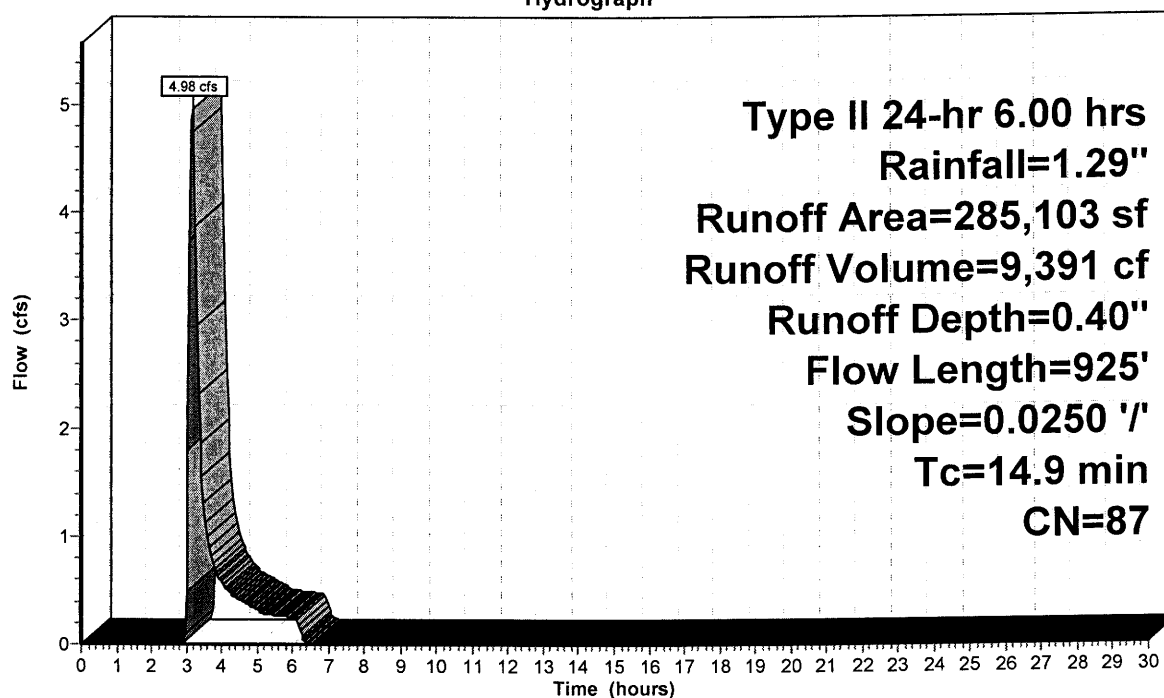
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 6.00 hrs Rainfall=1.29"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 285,103 | 87 |               |
| 285,103   |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 14.9     | 925           | 0.0250        | 1.04              |                | Lag/CN Method, |

### Subcatchment E-5: Watershed E-5

Hydrograph



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Type II 24-hr 6.00 hrs Rainfall=1.29"

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## **Summary for Reach C1: Culvert C-1**

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 66,123 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.42 cfs @ 3.12 hrs, Volume= 2,178 cf  
 Outflow = 1.40 cfs @ 3.12 hrs, Volume= 2,178 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.46 fps, Min. Travel Time= 0.1 min

Avg. Velocity= 1.99 fps, Avg. Travel Time= 0.3 min

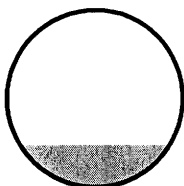
Peak Storage= 13 cf @ 3.12 hrs, Average Depth at Peak Storage= 0.35'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.83 cfs

18.0" Diameter Pipe, n= 0.020 Corrugated PE, corrugated interior

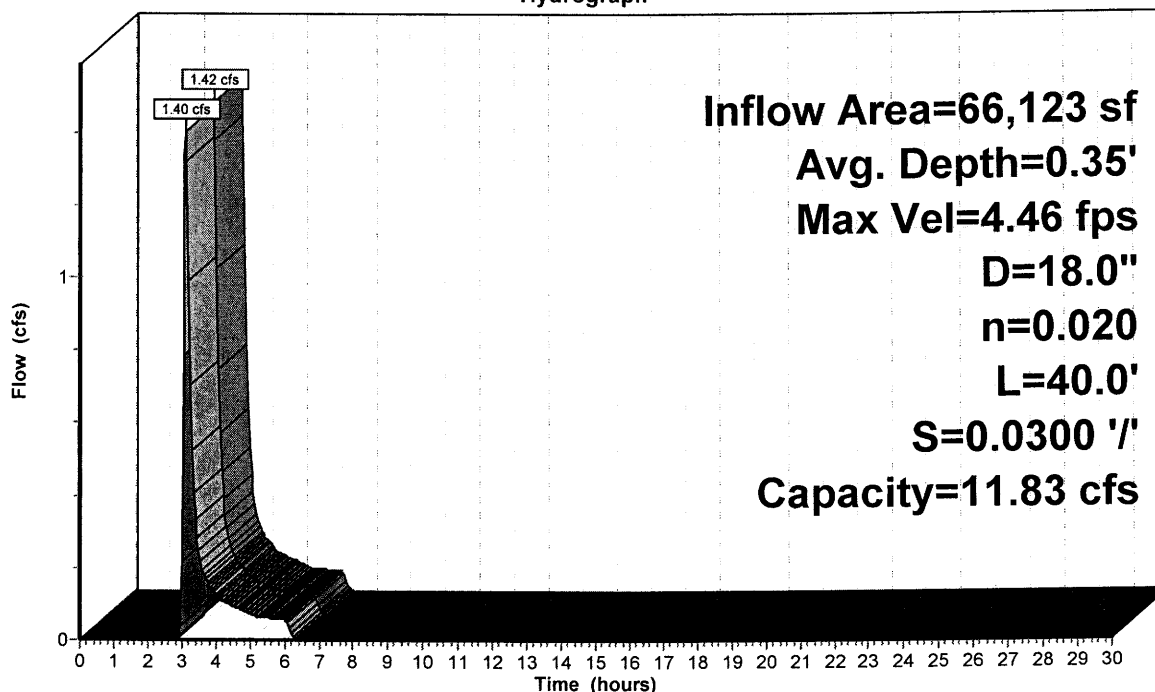
Length= 40.0' Slope= 0.0300 '/'

Inlet Invert= 5,520.70', Outlet Invert= 5,519.50'



## **Reach C1: Culvert C-1**

### **Hydrograph**



**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Reach C2: Culvert C-2**

[52] Hint: Inlet/Outlet conditions not evaluated

[61] Hint: Exceeded Reach E4D outlet invert by 0.24' @ 3.15 hrs

Inflow Area = 29,947 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 0.65 cfs @ 3.16 hrs, Volume= 986 cf  
 Outflow = 0.63 cfs @ 3.16 hrs, Volume= 988 cf, Atten= 3%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2

Max. Velocity= 3.45 fps, Min. Travel Time= 0.2 min

Avg. Velocity= 1.27 fps, Avg. Travel Time= 0.5 min

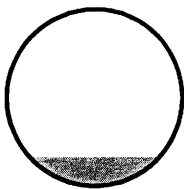
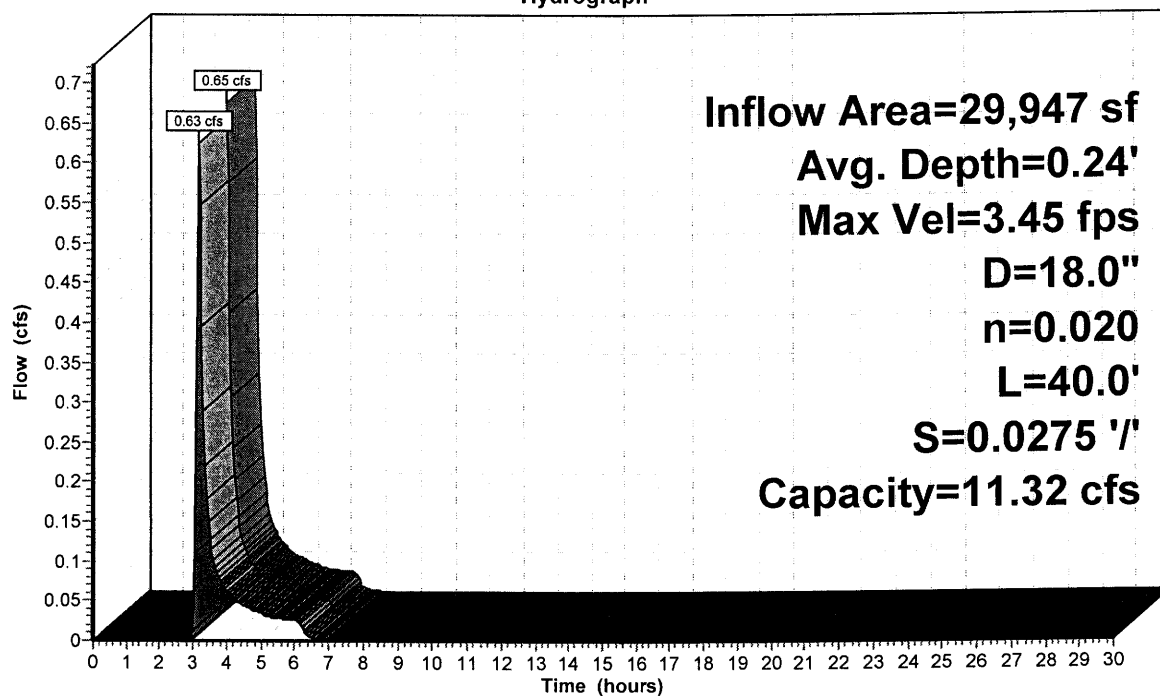
Peak Storage= 7 cf @ 3.16 hrs, Average Depth at Peak Storage= 0.24'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.32 cfs

18.0" Diameter Pipe, n= 0.020 Corrugated PE, corrugated interior

Length= 40.0' Slope= 0.0275 '/

Inlet Invert= 5,509.80', Outlet Invert= 5,508.70'

**Reach C2: Culvert C-2****Hydrograph**

■ Inflow  
 ■ Outflow

# **25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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## **Summary for Reach C6: Culvert C-6**

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 289,991 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 4.88 cfs @ 3.18 hrs, Volume= 9,552 cf  
 Outflow = 4.80 cfs @ 3.20 hrs, Volume= 9,552 cf, Atten= 2%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.83 fps, Min. Travel Time= 0.7 min

Avg. Velocity = 2.13 fps, Avg. Travel Time= 1.6 min

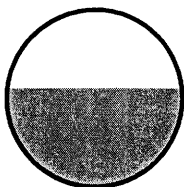
Peak Storage= 202 cf @ 3.19 hrs, Average Depth at Peak Storage= 0.83'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 8.19 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

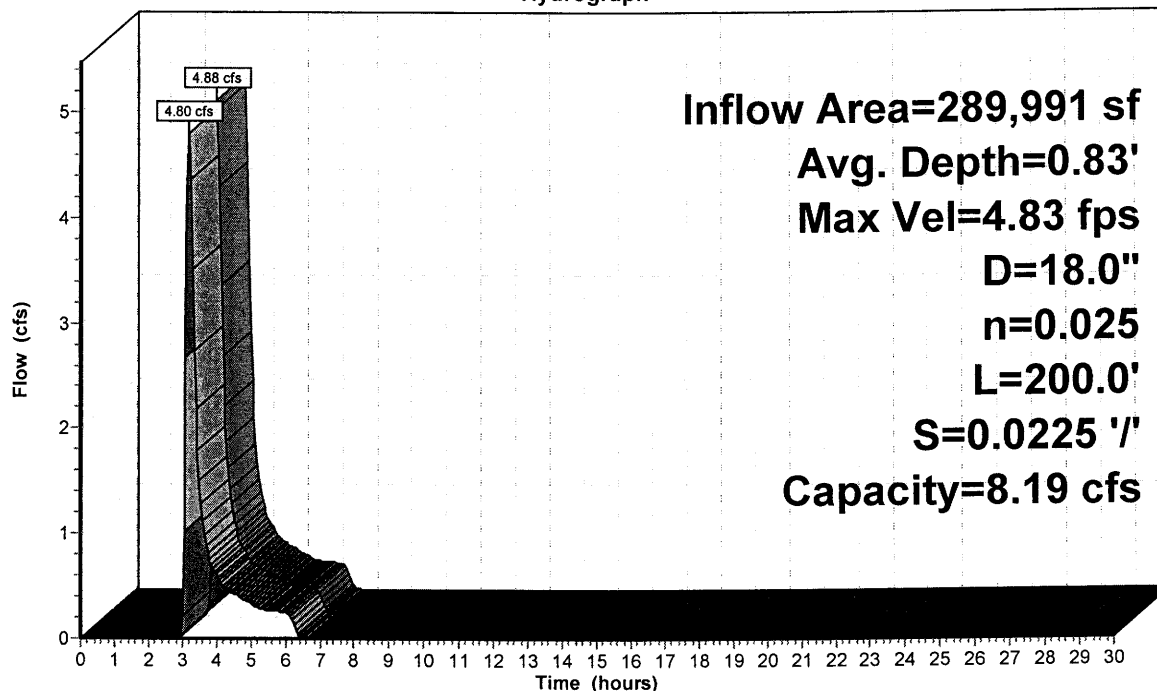
Length= 200.0' Slope= 0.0225 '/'

Inlet Invert= 5,514.00', Outlet Invert= 5,509.50'



## **Reach C6: Culvert C-6**

### **Hydrograph**



# **25yr-6hr East Pond**

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## **Summary for Reach C7: Culvert C-7**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach E1DL OUTLET depth by 1.21' @ 3.30 hrs

[62] Warning: Exceeded Reach E3D OUTLET depth by 1.07' @ 3.45 hrs

[62] Warning: Exceeded Reach E5D OUTLET depth by 1.24' @ 3.40 hrs

Inflow Area = 759,267 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 9.25 cfs @ 3.32 hrs, Volume= 25,010 cf  
 Outflow = 9.24 cfs @ 3.32 hrs, Volume= 25,010 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 11.54 fps, Min. Travel Time= 0.0 min

Avg. Velocity= 3.86 fps, Avg. Travel Time= 0.1 min

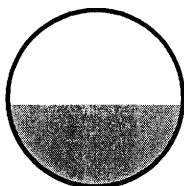
Peak Storage= 16 cf @ 3.32 hrs, Average Depth at Peak Storage= 0.69'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 21.16 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

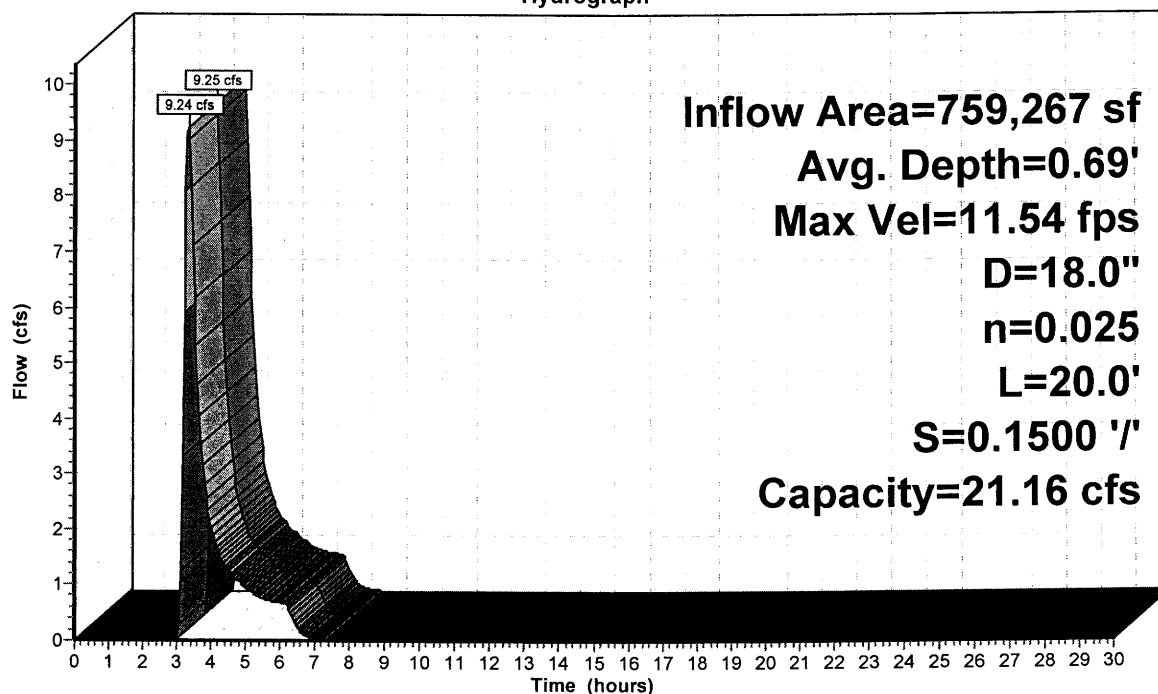
Length= 20.0' Slope= 0.1500 '/'

Inlet Invert= 5,505.00', Outlet Invert= 5,502.00'



## **Reach C7: Culvert C-7**

### **Hydrograph**



**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Reach E1DL: Lower E-1 Ditch**

[62] Warning: Exceeded Reach C2 OUTLET depth by 0.56' @ 3.40 hrs

[61] Hint: Exceeded Reach E1DU outlet invert by 0.69' @ 3.35 hrs

Inflow Area = 184,173 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.75 cfs @ 3.33 hrs, Volume= 6,068 cf  
 Outflow = 1.74 cfs @ 3.40 hrs, Volume= 6,068 cf, Atten= 1%, Lag= 4.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.42 fps, Min. Travel Time= 2.0 min

Avg. Velocity= 0.89 fps, Avg. Travel Time= 5.4 min

Peak Storage= 207 cf @ 3.36 hrs, Average Depth at Peak Storage= 0.69'

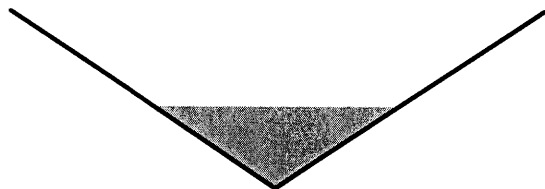
Bank-Full Depth= 1.50', Capacity at Bank-Full= 13.67 cfs

0.00' x 1.50' deep channel, n= 0.035

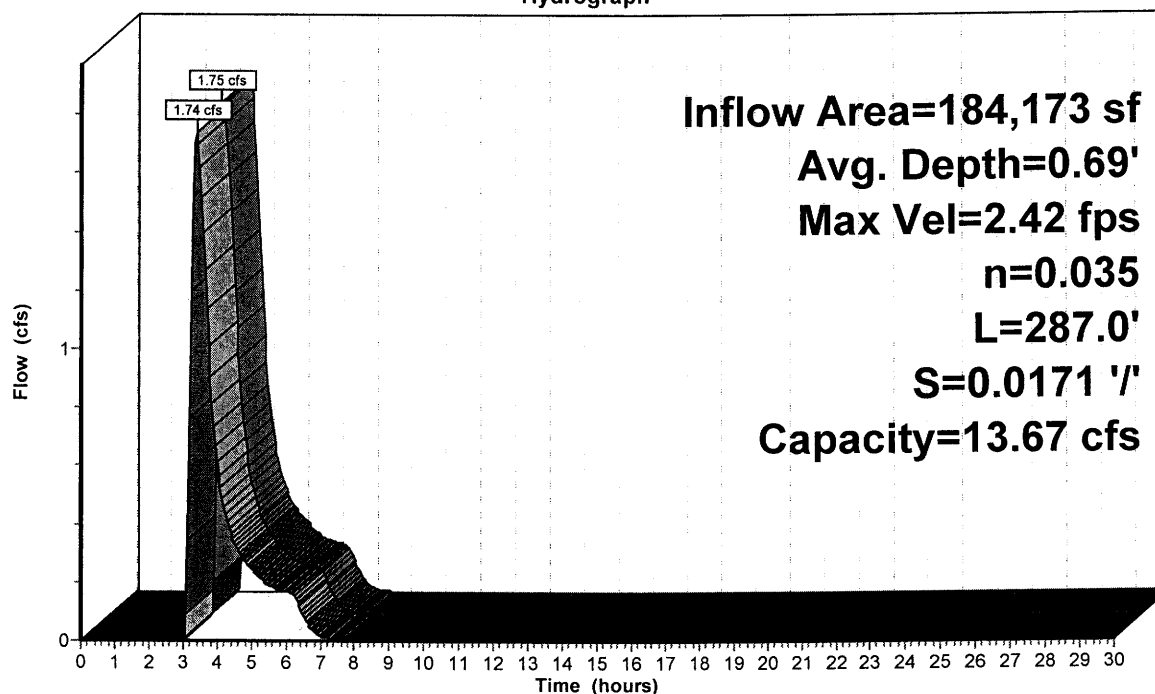
Side Slope Z-value= 1.5 '/' Top Width= 4.50'

Length= 287.0' Slope= 0.0171 '/'

Inlet Invert= 5,508.70', Outlet Invert= 5,503.80'

**Reach E1DL: Lower E-1 Ditch**

Hydrograph



■ Inflow  
 ■ Outflow



# **25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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## **Summary for Reach E1DU: Upper E-1 Ditch**

[62] Warning: Exceeded Reach C1 OUTLET depth by 0.62' @ 3.40 hrs

Inflow Area = 154,226 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.75 cfs @ 3.16 hrs, Volume= 5,080 cf  
 Outflow = 1.53 cfs @ 3.37 hrs, Volume= 5,080 cf, Atten= 12%, Lag= 12.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.28 fps, Min. Travel Time= 5.3 min

Avg. Velocity = 0.85 fps, Avg. Travel Time= 14.2 min

Peak Storage= 485 cf @ 3.27 hrs, Average Depth at Peak Storage= 0.82'

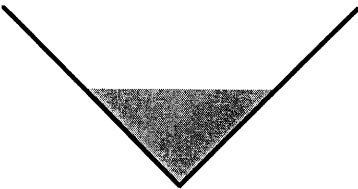
Bank-Full Depth= 1.50', Capacity at Bank-Full= 7.67 cfs

0.00' x 1.50' deep channel, n= 0.035

Side Slope Z-value= 1.0 '/' Top Width= 3.00'

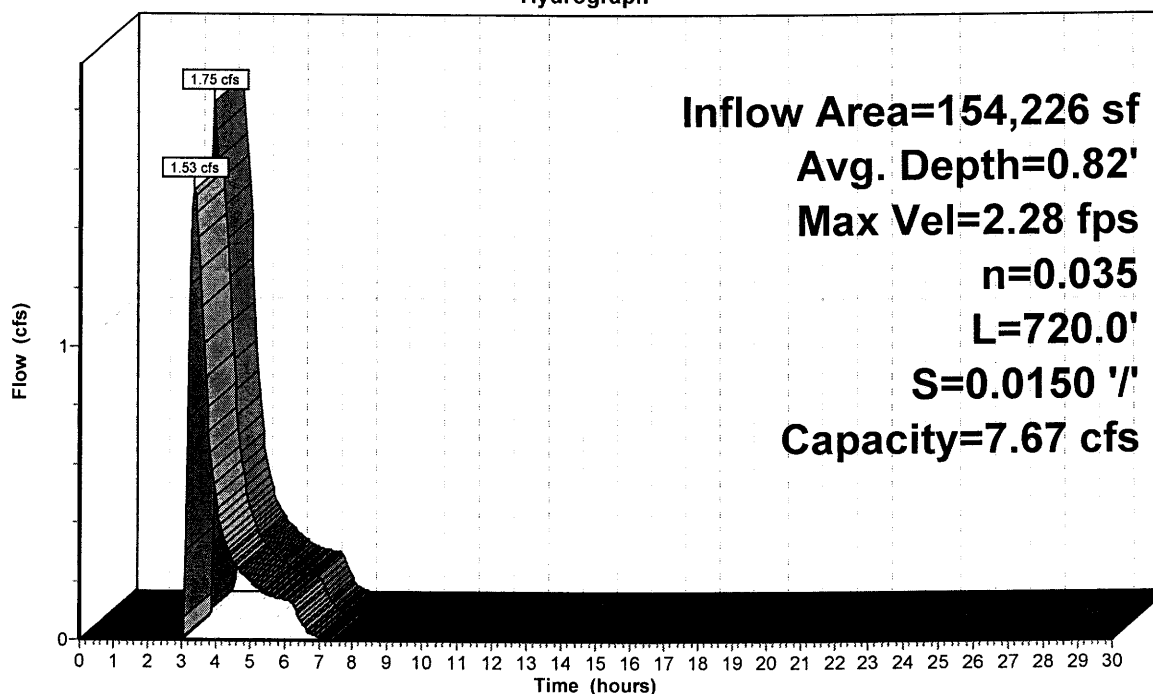
Length= 720.0' Slope= 0.0150 '/'

Inlet Invert= 5,519.50', Outlet Invert= 5,508.70'



## **Reach E1DU: Upper E-1 Ditch**

### **Hydrograph**



■ Inflow  
 ■ Outflow

**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Reach E3D: E-3 Ditch**

[62] Warning: Exceeded Reach C6 OUTLET depth by 0.07' @ 3.35 hrs

Inflow Area = 289,991 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 4.80 cfs @ 3.20 hrs, Volume= 9,552 cf  
 Outflow = 4.62 cfs @ 3.25 hrs, Volume= 9,552 cf, Atten= 4%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.18 fps, Min. Travel Time= 1.5 min

Avg. Velocity = 1.36 fps, Avg. Travel Time= 3.5 min

Peak Storage= 421 cf @ 3.22 hrs, Average Depth at Peak Storage= 0.79'

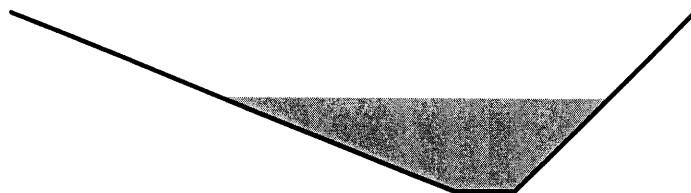
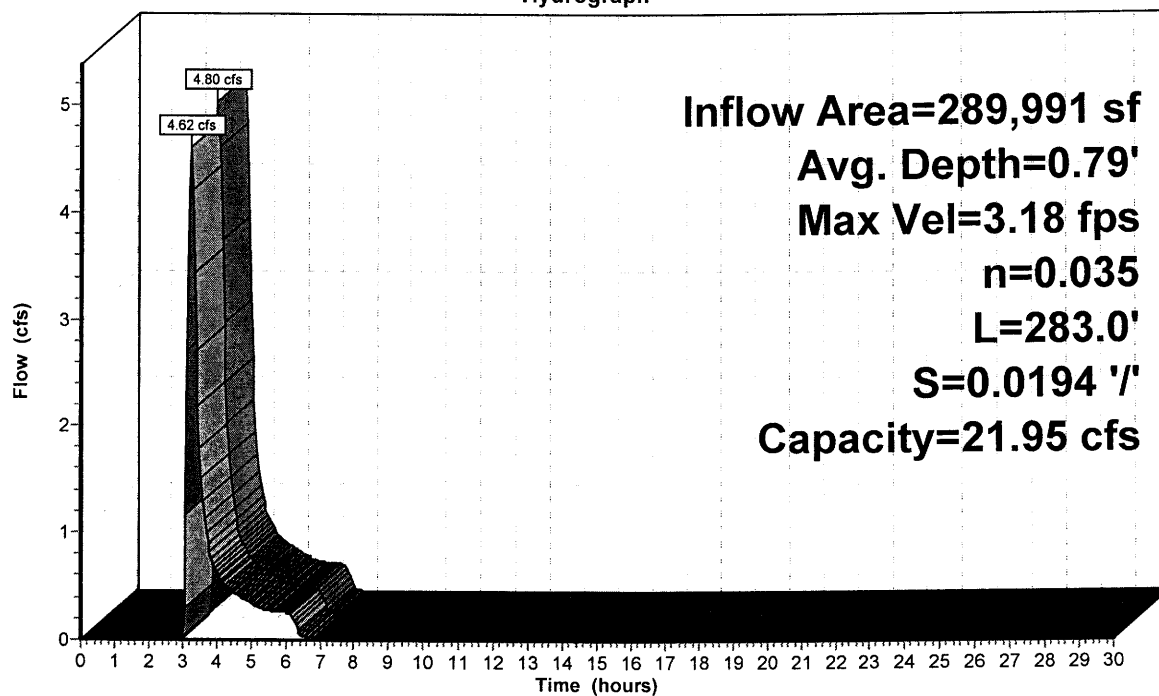
Bank-Full Depth= 1.50', Capacity at Bank-Full= 21.95 cfs

0.50' x 1.50' deep channel, n= 0.035

Side Slope Z-value= 2.5 1.0 '/' Top Width= 5.75'

Length= 283.0' Slope= 0.0194 '/'

Inlet Invert= 5,509.50', Outlet Invert= 5,504.00'

**Reach E3D: E-3 Ditch****Hydrograph**

■ Inflow  
 ■ Outflow

**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Reach E4D: E-4 Ditch**

Inflow Area = 29,947 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.16 cfs @ 3.01 hrs, Volume= 986 cf  
 Outflow = 0.65 cfs @ 3.16 hrs, Volume= 986 cf, Atten= 44%, Lag= 8.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.83 fps, Min. Travel Time= 5.1 min

Avg. Velocity= 0.64 fps, Avg. Travel Time= 14.6 min

Peak Storage= 207 cf @ 3.07 hrs, Average Depth at Peak Storage= 0.50'

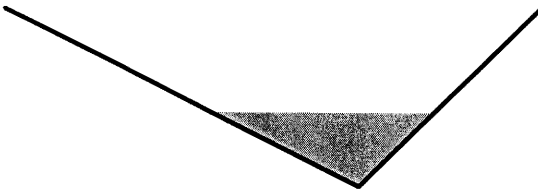
Bank-Full Depth= 1.20', Capacity at Bank-Full= 7.21 cfs

0.00' x 1.20' deep channel, n= 0.035

Side Slope Z-value= 2.0 1.0 '/' Top Width= 3.60'

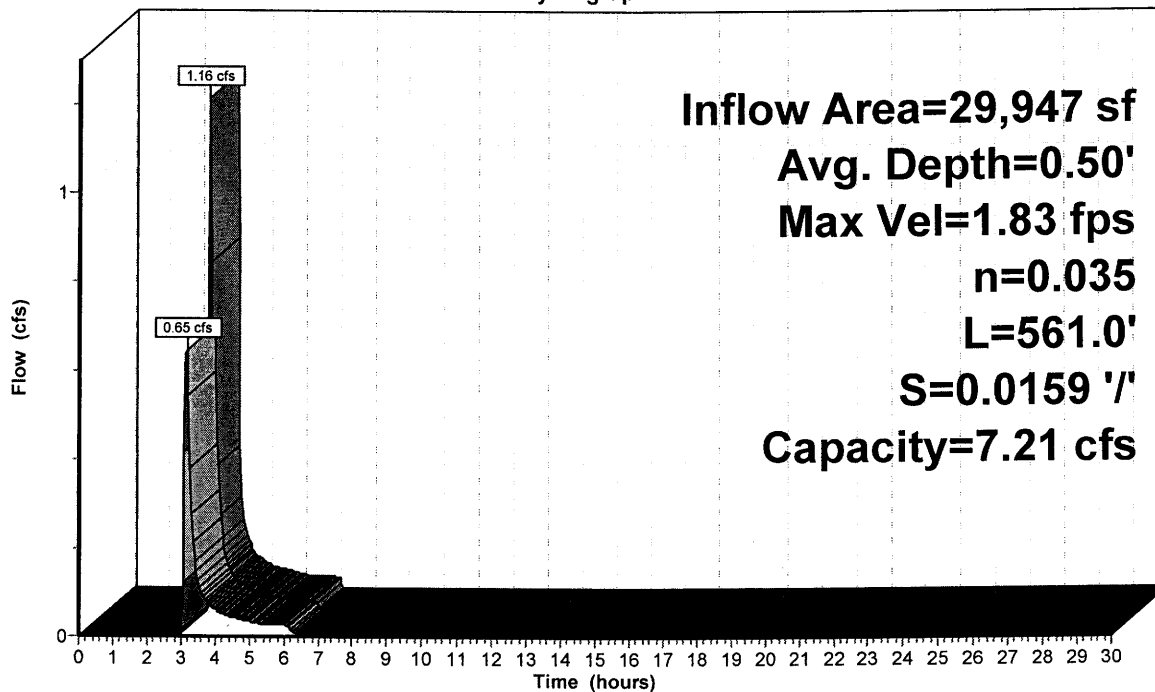
Length= 561.0' Slope= 0.0159 '/'

Inlet Invert= 5,518.70', Outlet Invert= 5,509.80'



**Reach E4D: E-4 Ditch**

**Hydrograph**



# **25yr-6hr East Pond**

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## **Summary for Reach E5D: E-5 Ditch**

Inflow Area = 285,103 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 4.98 cfs @ 3.17 hrs, Volume= 9,391 cf  
 Outflow = 3.89 cfs @ 3.36 hrs, Volume= 9,391 cf, Atten= 22%, Lag= 11.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.98 fps, Min. Travel Time= 6.3 min

Avg. Velocity= 0.54 fps, Avg. Travel Time= 23.0 min

Peak Storage= 1,475 cf @ 3.26 hrs, Average Depth at Peak Storage= 0.70'

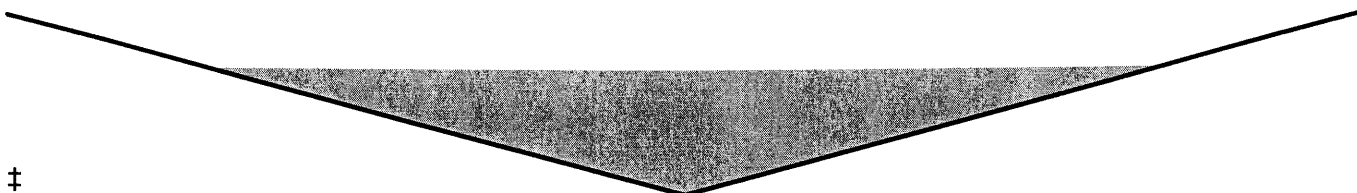
Bank-Full Depth= 1.00', Capacity at Bank-Full= 10.01 cfs

0.00' x 1.00' deep channel, n= 0.035

Side Slope Z-value= 4.0 ' ' Top Width= 8.00'

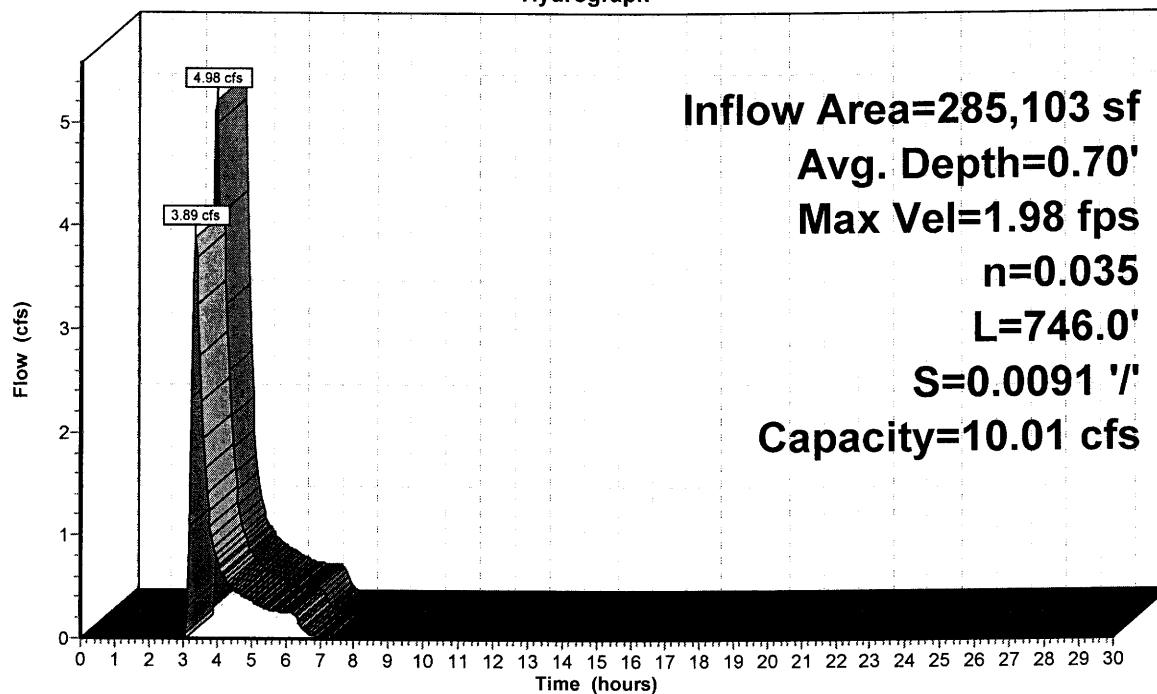
Length= 746.0' Slope= 0.0091 ' '

Inlet Invert= 5,510.60', Outlet Invert= 5,503.80'



## **Reach E5D: E-5 Ditch**

### **Hydrograph**



☒ Inflow  
☐ Outflow

**25yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Pond EP: East Sed Pond**

[62] Warning: Exceeded Reach C7 OUTLET depth by 1.96' @ 4.15 hrs

Inflow Area = 759,267 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 9.24 cfs @ 3.32 hrs, Volume= 25,010 cf  
 Outflow = 2.26 cfs @ 3.92 hrs, Volume= 18,184 cf, Atten= 76%, Lag= 36.3 min  
 Primary = 2.26 cfs @ 3.92 hrs, Volume= 18,184 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2

Starting Elev= 5,503.00' Surf.Area= 9,328 sf Storage= 48,972 cf

Peak Elev= 5,504.26' @ 3.92 hrs Surf.Area= 10,660 sf Storage= 61,684 cf (12,712 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 75.7 min ( 316.4 - 240.7 )

| Volume | Invert    | Avail.Storage | Storage Description  |
|--------|-----------|---------------|--|
| #1     | 5,493.80' | 78,991 cf     | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 5,493.80            | 2,550                | 0                         | 0                         |
| 5,494.80            | 2,601                | 2,576                     | 2,576                     |
| 5,495.80            | 3,214                | 2,908                     | 5,483                     |
| 5,496.80            | 3,909                | 3,562                     | 9,045                     |
| 5,497.80            | 4,637                | 4,273                     | 13,318                    |
| 5,498.80            | 5,425                | 5,031                     | 18,349                    |
| 5,499.80            | 6,243                | 5,834                     | 24,183                    |
| 5,500.80            | 7,158                | 6,701                     | 30,883                    |
| 5,501.80            | 8,125                | 7,642                     | 38,525                    |
| 5,502.80            | 9,087                | 8,606                     | 47,131                    |
| 5,503.80            | 10,291               | 9,689                     | 56,820                    |
| 5,505.80            | 11,880               | 22,171                    | 78,991                    |

| Device | Routing | Invert    | Outlet Devices   |
|--------|---------|-----------|--|
| #1     | Primary | 5,503.70' | <b>2.0' long x 3.0' breadth Broad-Crested Rectangular Weir</b>         |
|        |         |           | Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50     |
|        |         |           | 3.00 3.50 4.00 4.50  |
|        |         |           | Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 |
|        |         |           | 2.92 2.97 3.07 3.32  |

Primary OutFlow Max=2.25 cfs @ 3.92 hrs HW=5,504.26' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Weir Controls 2.25 cfs @ 2.00 fps)

**25yr-6hr East Pond**

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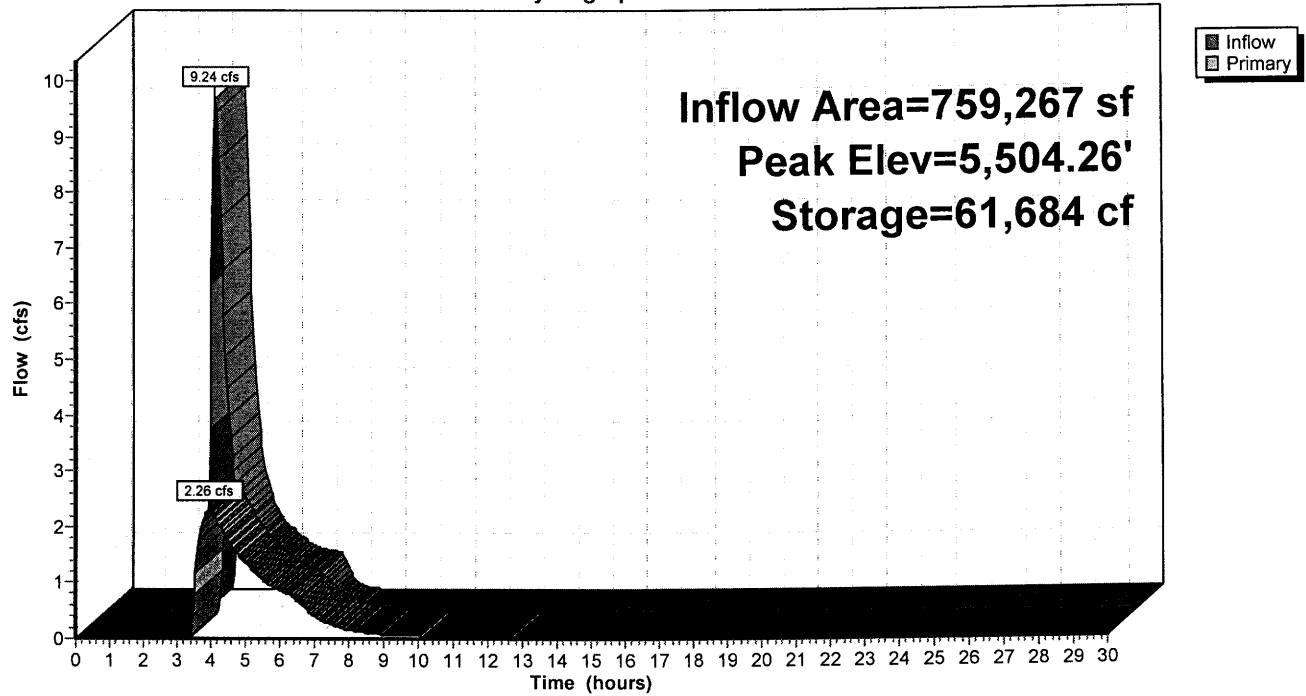
Type II 24-hr 6.00 hrs Rainfall=1.29"

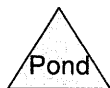
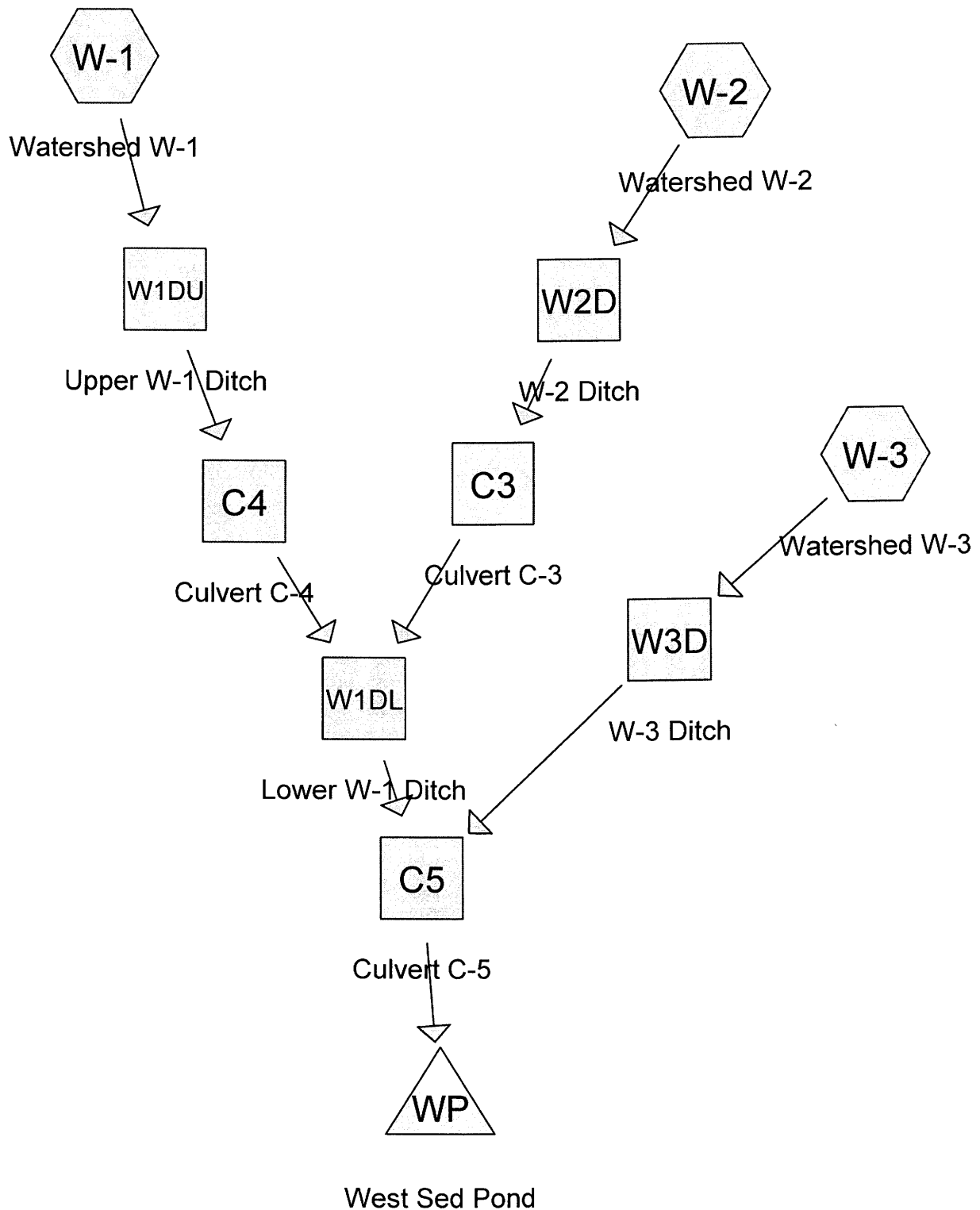
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**Pond EP: East Sed Pond**

**Hydrograph**





#### Drainage Diagram for 25yr-6hr West Pond

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**25yr-6hr West Pond**

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**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN | Description<br>(subcatchment-numbers) |
|-----------------|----|---------------------------------------|
| 305,034         | 87 | (W-1,W-2,W-3)                         |
| 305,034         |    | <b>TOTAL AREA</b>                     |



**25yr-6hr West Pond**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 0               | HSG A         |                         |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| <b>305,034</b>  | Other         | W-1, W-2, W-3           |
| 305,034         |               | <b>TOTAL AREA</b>       |

**25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment W-1: Watershed W-1** Runoff Area=105,474 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=1,297' Slope=0.0250 '/' Tc=19.5 min CN=87 Runoff=1.50 cfs 3,474 cf

**Subcatchment W-2: Watershed W-2** Runoff Area=128,724 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=635' Slope=0.0250 '/' Tc=11.0 min CN=87 Runoff=2.79 cfs 4,240 cf

**Subcatchment W-3: Watershed W-3** Runoff Area=70,836 sf 0.00% Impervious Runoff Depth=0.40"  
Flow Length=447' Slope=0.0270 '/' Tc=8.0 min CN=87 Runoff=1.81 cfs 2,333 cf

**Reach C3: Culvert C-3** Avg. Depth=0.49' Max Vel=4.51 fps Inflow=2.24 cfs 4,240 cf  
D=18.0" n=0.025 L=40.0' S=0.0325 '/' Capacity=9.85 cfs Outflow=2.23 cfs 4,240 cf

**Reach C4: Culvert C-4** Avg. Depth=0.44' Max Vel=2.76 fps Inflow=1.18 cfs 3,474 cf  
D=18.0" n=0.025 L=80.0' S=0.0138 '/' Capacity=6.41 cfs Outflow=1.17 cfs 3,474 cf

**Reach C5: Culvert C-5** Avg. Depth=0.34' Max Vel=9.02 fps Inflow=2.70 cfs 10,047 cf  
D=18.0" n=0.025 L=20.0' S=0.1950 '/' Capacity=24.12 cfs Outflow=2.70 cfs 10,047 cf

**Reach W1DL: Lower W-1 Ditch** Avg. Depth=0.78' Max Vel=1.95 fps Inflow=2.44 cfs 7,714 cf  
n=0.035 L=320.0' S=0.0088 '/' Capacity=29.49 cfs Outflow=2.35 cfs 7,714 cf

**Reach W1DU: Upper W-1 Ditch** Avg. Depth=0.55' Max Vel=2.00 fps Inflow=1.50 cfs 3,474 cf  
n=0.035 L=963.0' S=0.0145 '/' Capacity=38.02 cfs Outflow=1.18 cfs 3,474 cf

**Reach W2D: W-2 Ditch** Avg. Depth=0.26' Max Vel=2.00 fps Inflow=2.79 cfs 4,240 cf  
n=0.035 L=500.0' S=0.0158 '/' Capacity=23.56 cfs Outflow=2.24 cfs 4,240 cf

**Reach W3D: W-3 Ditch** Avg. Depth=0.56' Max Vel=2.13 fps Inflow=1.81 cfs 2,333 cf  
n=0.035 L=160.0' S=0.0156 '/' Capacity=8.65 cfs Outflow=1.66 cfs 2,333 cf

**Pond WP: West Sed Pond** Peak Elev=5,508.11' Storage=36,065 cf Inflow=2.70 cfs 10,047 cf  
Outflow=0.29 cfs 411 cf

**Total Runoff Area = 305,034 sf Runoff Volume = 10,047 cf Average Runoff Depth = 0.40"**  
**100.00% Pervious = 305,034 sf 0.00% Impervious = 0 sf**

**25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment W-1: Watershed W-1**

Runoff = 1.50 cfs @ 3.23 hrs, Volume= 3,474 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

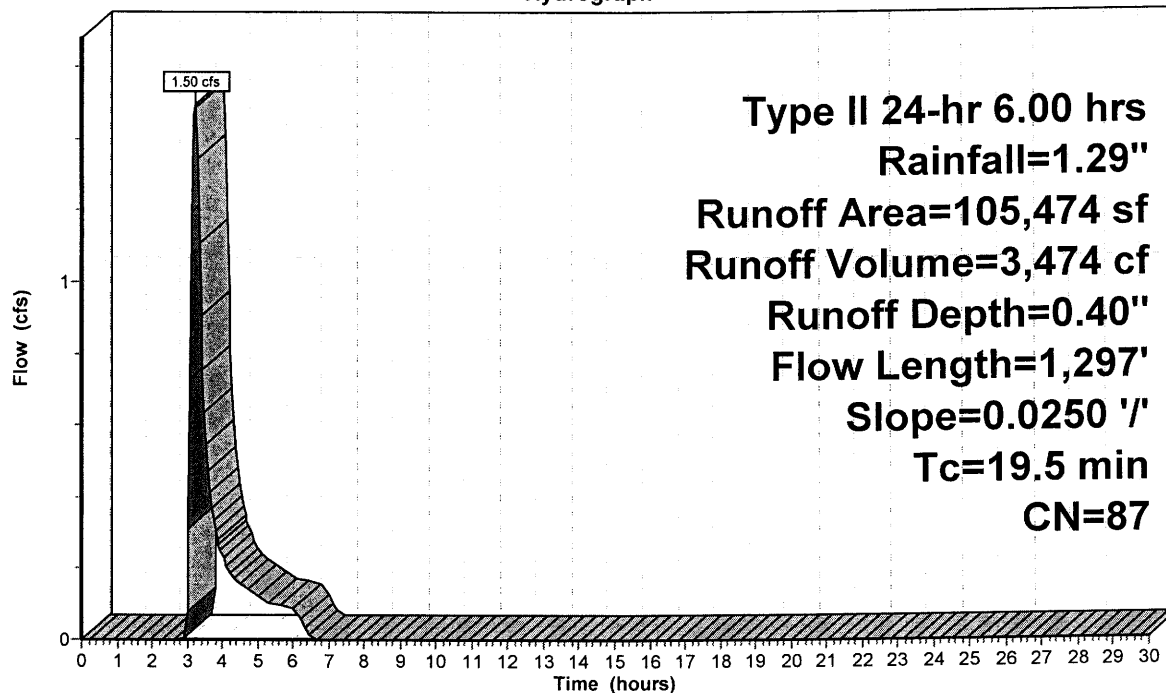
Type II 24-hr 6.00 hrs Rainfall=1.29"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 105,474 | 87 |               |
| 105,474   |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 19.5     | 1,297         | 0.0250        | 1.11              |                | Lag/CN Method, |

**Subcatchment W-1: Watershed W-1**

Hydrograph



**25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment W-2: Watershed W-2**

Runoff = 2.79 cfs @ 3.12 hrs, Volume= 4,240 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

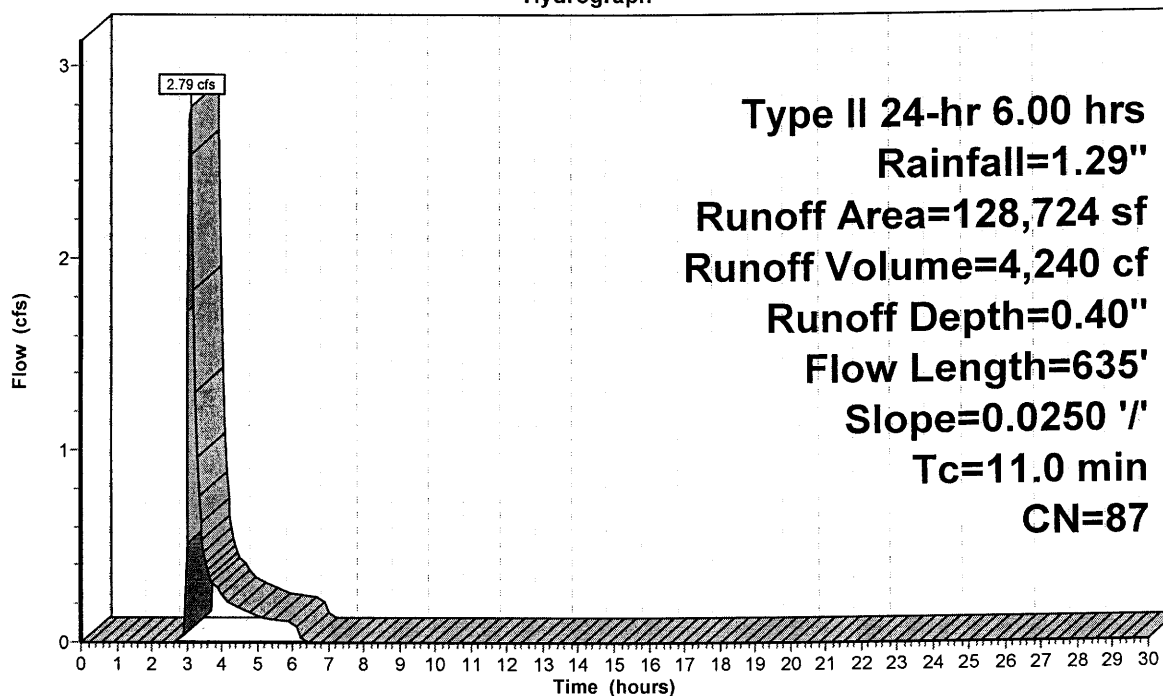
Type II 24-hr 6.00 hrs Rainfall=1.29"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 128,724   | 87 |               |
|   | 128,724   |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 11.0        | 635              | 0.0250           | 0.96                 |                   | Lag/CN Method, |

**Subcatchment W-2: Watershed W-2**

Hydrograph



Runoff

**25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Subcatchment W-3: Watershed W-3**

Runoff = 1.81 cfs @ 3.08 hrs, Volume= 2,333 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

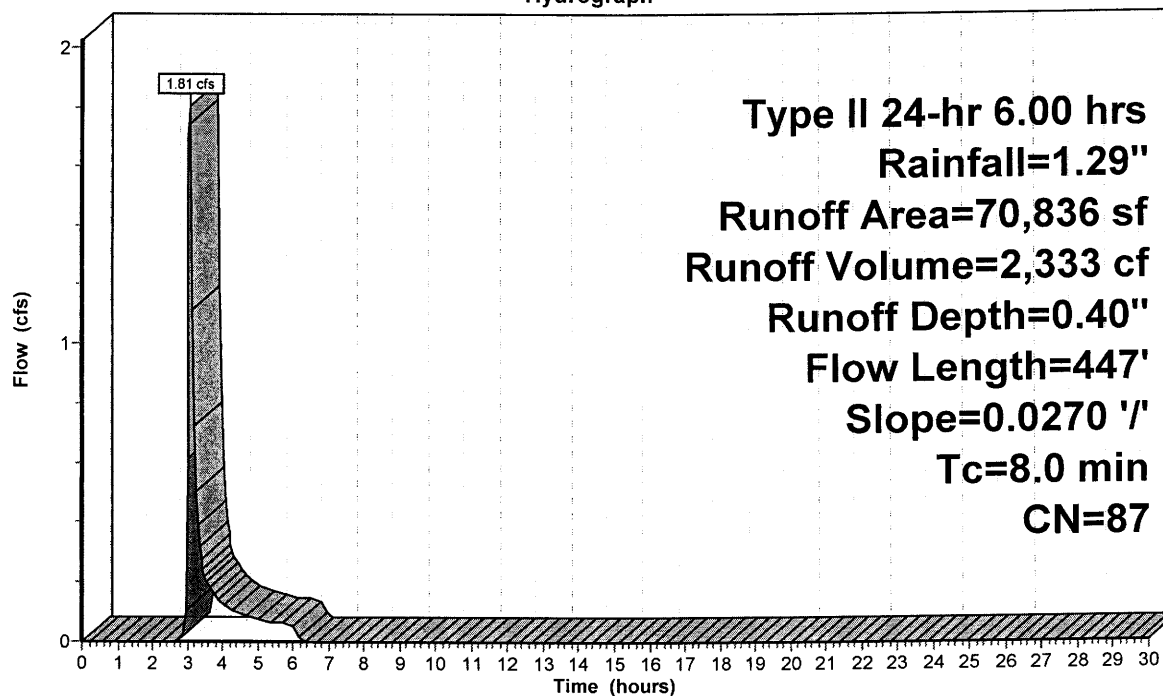
Type II 24-hr 6.00 hrs Rainfall=1.29"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 70,836  | 87 |               |
| 70,836    |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 8.0      | 447           | 0.0270        | 0.93              |                | Lag/CN Method, |

**Subcatchment W-3: Watershed W-3**

Hydrograph



Runoff

**25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Reach C3: Culvert C-3**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W2D OUTLET depth by 0.26' @ 3.25 hrs

Inflow Area = 128,724 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 2.24 cfs @ 3.25 hrs, Volume= 4,240 cf  
 Outflow = 2.23 cfs @ 3.25 hrs, Volume= 4,240 cf, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.51 fps, Min. Travel Time= 0.1 min

Avg. Velocity= 1.47 fps, Avg. Travel Time= 0.5 min

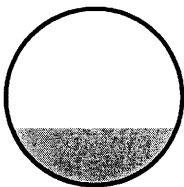
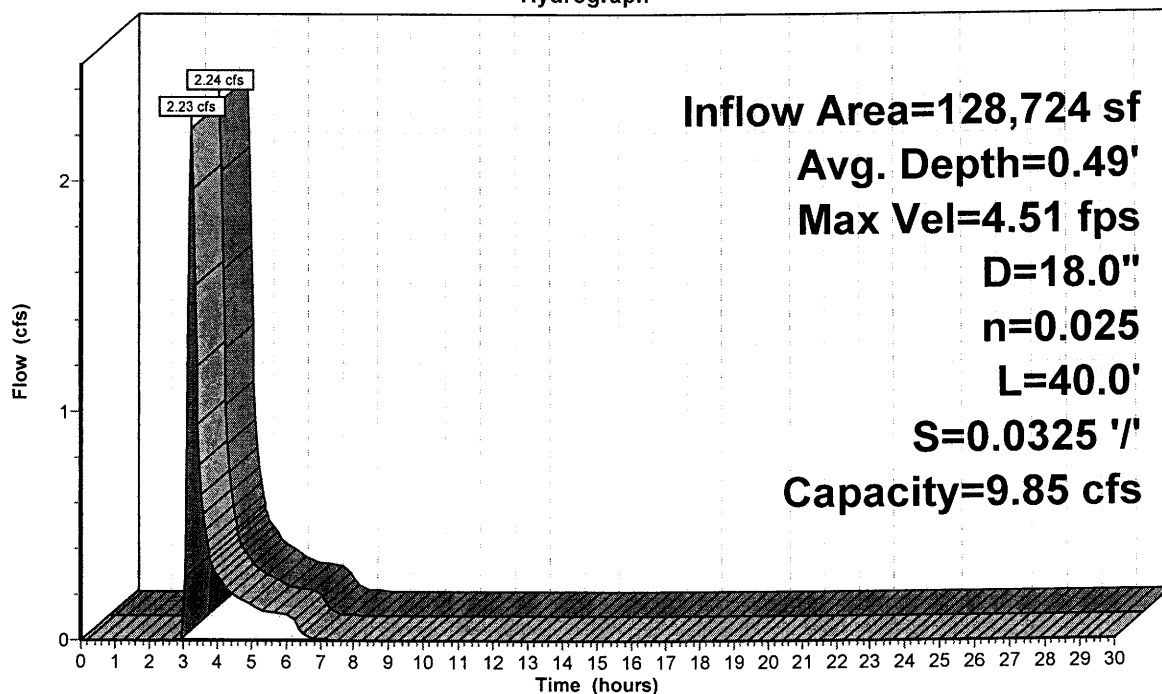
Peak Storage= 20 cf @ 3.25 hrs, Average Depth at Peak Storage= 0.49'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 9.85 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

Length= 40.0' Slope= 0.0325 '/'

Inlet Invert= 5,512.10', Outlet Invert= 5,510.80'

**Reach C3: Culvert C-3****Hydrograph**

■ Inflow  
 ■ Outflow

# **25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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## **Summary for Reach C4: Culvert C-4**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W1DU OUTLET depth by 1.20' @ 0.00 hrs

Inflow Area = 105,474 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.18 cfs @ 3.47 hrs, Volume= 3,474 cf  
 Outflow = 1.17 cfs @ 3.49 hrs, Volume= 3,474 cf, Atten= 1%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.76 fps, Min. Travel Time= 0.5 min

Avg. Velocity= 0.92 fps, Avg. Travel Time= 1.4 min

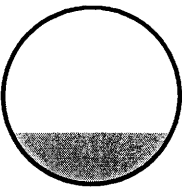
Peak Storage= 34 cf @ 3.48 hrs, Average Depth at Peak Storage= 0.44'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 6.41 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

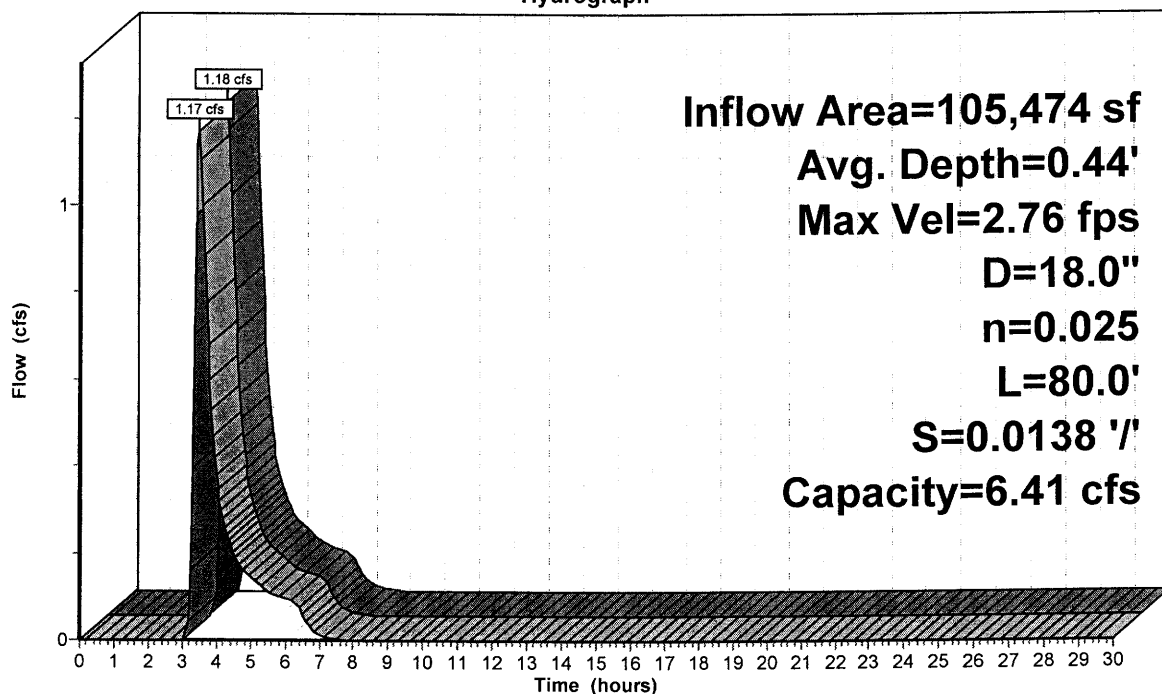
Length= 80.0' Slope= 0.0138 '/'

Inlet Invert= 5,512.00', Outlet Invert= 5,510.90'



## **Reach C4: Culvert C-4**

### **Hydrograph**



■ Inflow  
 ■ Outflow

### Summary for Reach C5: Culvert C-5

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W1DL OUTLET depth by 2.03' @ 3.05 hrs

[62] Warning: Exceeded Reach W3D OUTLET depth by 1.96' @ 3.50 hrs

Inflow Area = 305,034 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 2.70 cfs @ 3.36 hrs, Volume= 10,047 cf  
 Outflow = 2.70 cfs @ 3.36 hrs, Volume= 10,047 cf, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 9.02 fps, Min. Travel Time= 0.0 min

Avg. Velocity= 3.48 fps, Avg. Travel Time= 0.1 min

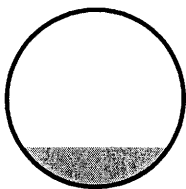
Peak Storage= 6 cf @ 3.36 hrs, Average Depth at Peak Storage= 0.34'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 24.12 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

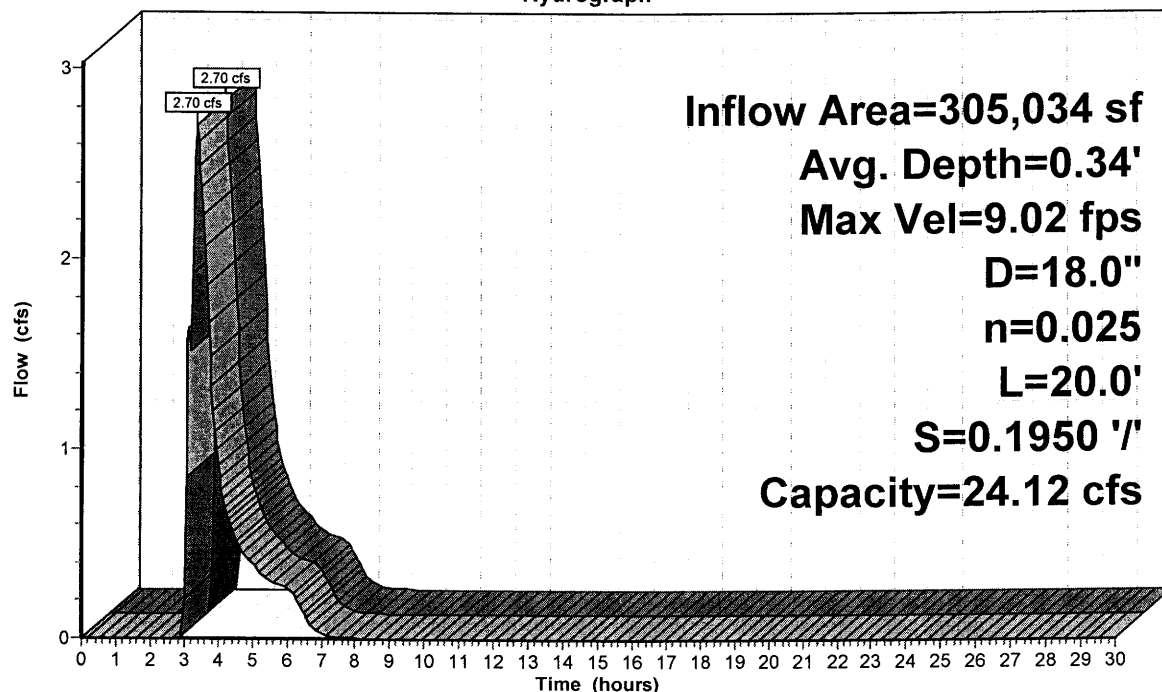
Length= 20.0' Slope= 0.1950 1'

Inlet Invert= 5,509.90', Outlet Invert= 5,506.00'



### Reach C5: Culvert C-5

#### Hydrograph



Legend:  
 Inflow (hatched pattern)  
 Outflow (solid black)



# **25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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## **Summary for Reach W1DL: Lower W-1 Ditch**

[62] Warning: Exceeded Reach C3 OUTLET depth by 0.45' @ 3.55 hrs

[62] Warning: Exceeded Reach C4 OUTLET depth by 0.45' @ 3.25 hrs

Inflow Area = 234,198 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 2.44 cfs @ 3.27 hrs, Volume= 7,714 cf  
 Outflow = 2.35 cfs @ 3.37 hrs, Volume= 7,714 cf, Atten= 4%, Lag= 6.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.95 fps, Min. Travel Time= 2.7 min

Avg. Velocity= 0.65 fps, Avg. Travel Time= 8.3 min

Peak Storage= 384 cf @ 3.32 hrs, Average Depth at Peak Storage= 0.78'

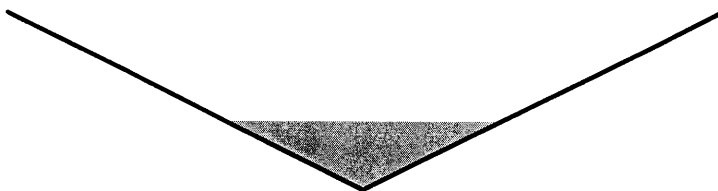
Bank-Full Depth= 2.00', Capacity at Bank-Full= 29.49 cfs

0.00' x 2.00' deep channel, n= 0.035

Side Slope Z-value= 2.0 '/' Top Width= 8.00'

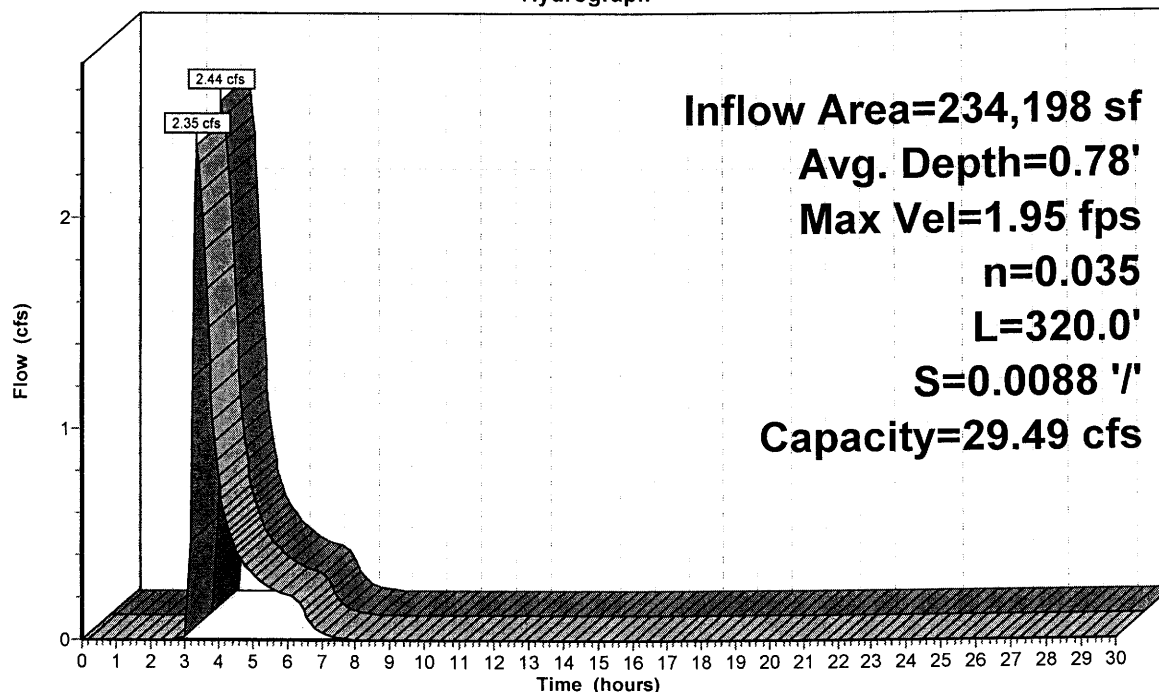
Length= 320.0' Slope= 0.0088 '/'

Inlet Invert= 5,510.80', Outlet Invert= 5,508.00'



## **Reach W1DL: Lower W-1 Ditch**

### **Hydrograph**



■ Inflow  
 ■ Outflow

# **25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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## **Summary for Reach W1DU: Upper W-1 Ditch**

Inflow Area = 105,474 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.50 cfs @ 3.23 hrs, Volume= 3,474 cf  
 Outflow = 1.18 cfs @ 3.47 hrs, Volume= 3,474 cf, Atten= 21%, Lag= 14.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.00 fps, Min. Travel Time= 8.0 min

Avg. Velocity= 0.70 fps, Avg. Travel Time= 22.8 min

Peak Storage= 572 cf @ 3.34 hrs, Average Depth at Peak Storage= 0.55'

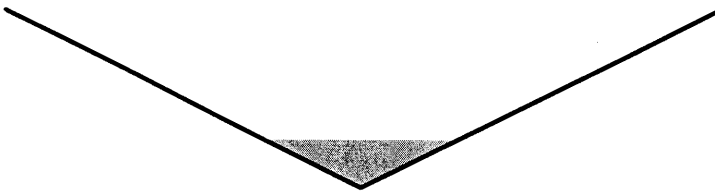
Bank-Full Depth= 2.00', Capacity at Bank-Full= 38.02 cfs

0.00' x 2.00' deep channel, n= 0.035

Side Slope Z-value= 2.0 '/' Top Width= 8.00'

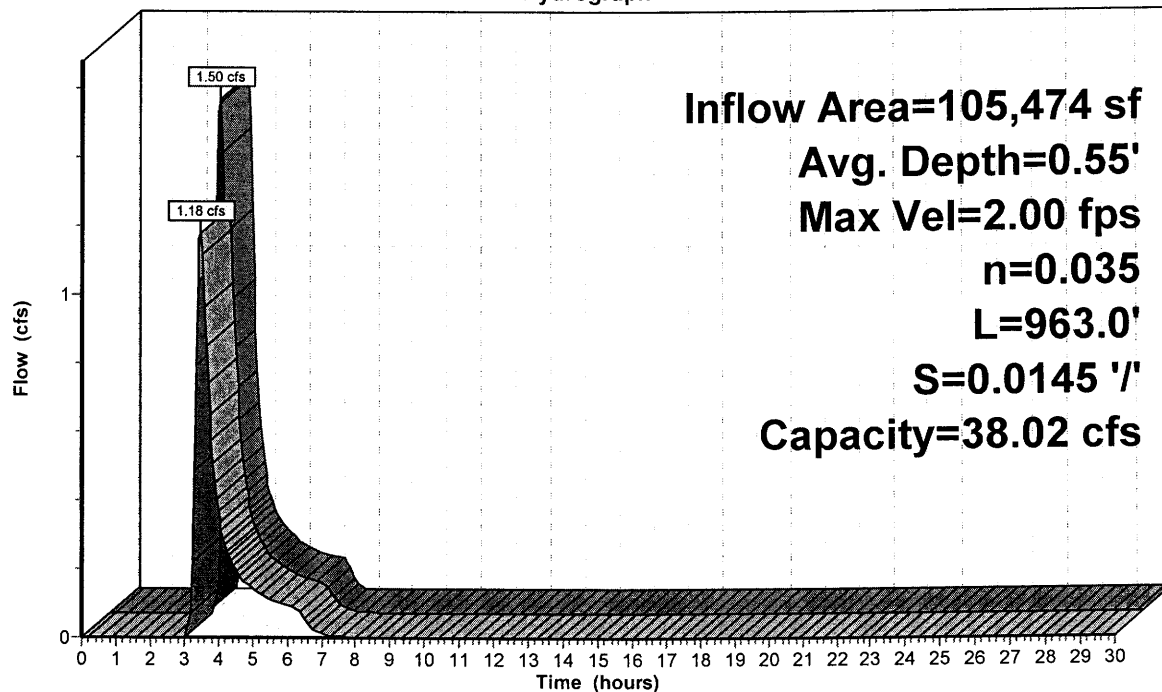
Length= 963.0' Slope= 0.0145 '/'

Inlet Invert= 5,524.80', Outlet Invert= 5,510.80'



## **Reach W1DU: Upper W-1 Ditch**

Hydrograph



# **25yr-6hr West Pond**

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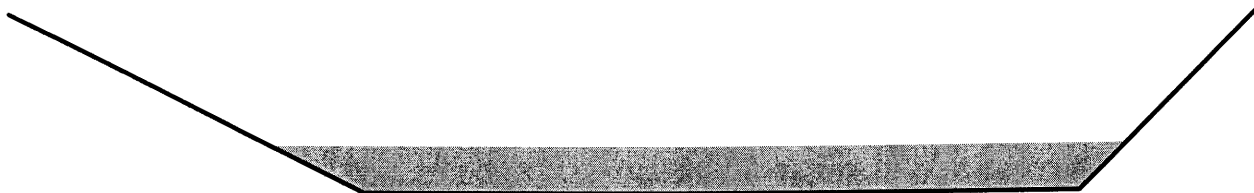
## **Summary for Reach W2D: W-2 Ditch**

Inflow Area = 128,724 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 2.79 cfs @ 3.12 hrs, Volume= 4,240 cf  
 Outflow = 2.24 cfs @ 3.25 hrs, Volume= 4,240 cf, Atten= 20%, Lag= 7.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 2.00 fps, Min. Travel Time= 4.2 min  
 Avg. Velocity = 0.55 fps, Avg. Travel Time= 15.3 min

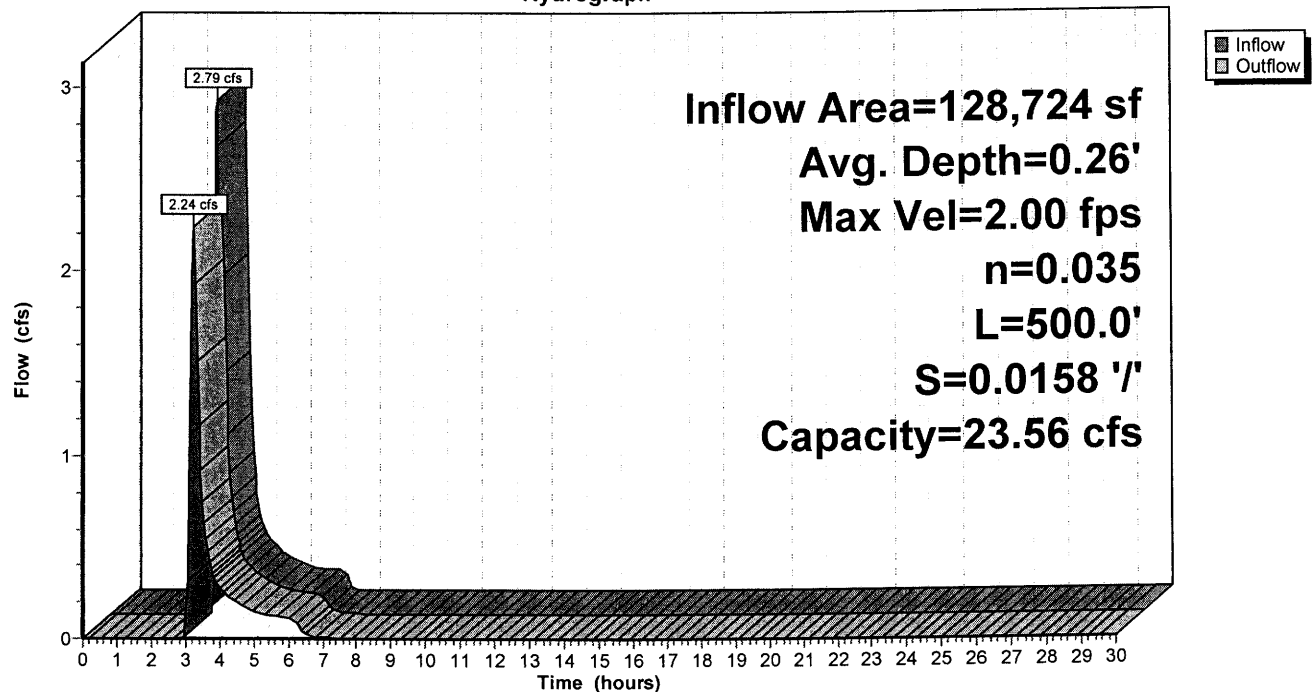
Peak Storage= 582 cf @ 3.17 hrs, Average Depth at Peak Storage= 0.26'  
 Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.56 cfs

4.00' x 1.00' deep channel, n= 0.035  
 Side Slope Z-value= 2.0 1.0 '/' Top Width= 7.00'  
 Length= 500.0' Slope= 0.0158 '/'  
 Inlet Invert= 5,520.00', Outlet Invert= 5,512.10'



## **Reach W2D: W-2 Ditch**

### **Hydrograph**



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## **Summary for Reach W3D: W-3 Ditch**

Inflow Area = 70,836 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 1.81 cfs @ 3.08 hrs, Volume= 2,333 cf  
 Outflow = 1.66 cfs @ 3.12 hrs, Volume= 2,333 cf, Atten= 8%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.13 fps, Min. Travel Time= 1.3 min

Avg. Velocity = 0.88 fps, Avg. Travel Time= 3.0 min

Peak Storage= 137 cf @ 3.10 hrs, Average Depth at Peak Storage= 0.56'

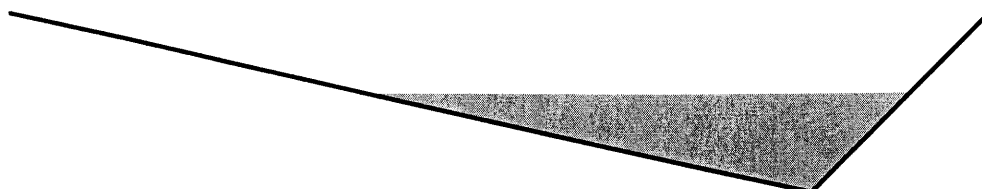
Bank-Full Depth= 1.00', Capacity at Bank-Full= 8.65 cfs

0.00' x 1.00' deep channel, n= 0.035

Side Slope Z-value= 4.5 1.0 '/' Top Width= 5.50'

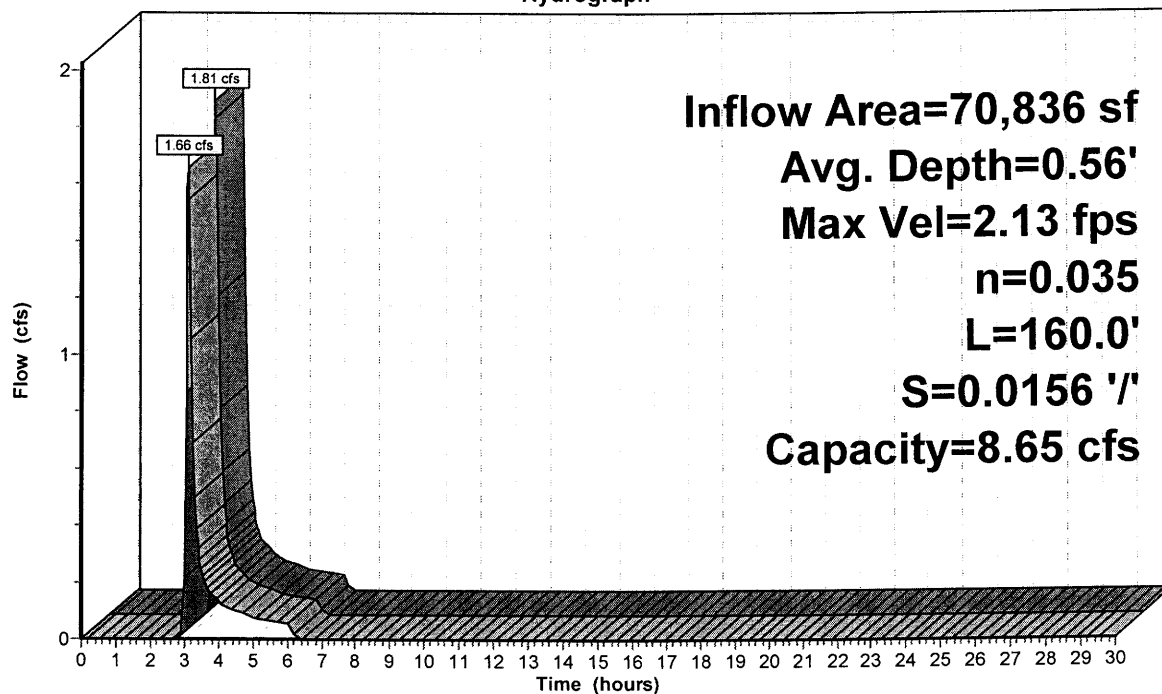
Length= 160.0' Slope= 0.0156 '/'

Inlet Invert= 5,510.50', Outlet Invert= 5,508.00'



## **Reach W3D: W-3 Ditch**

### **Hydrograph**



**25yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Summary for Pond WP: West Sed Pond**

[93] Warning: Storage range exceeded by 0.11'

[85] Warning: Oscillations may require Finer Routing&gt;1

[62] Warning: Exceeded Reach C5 OUTLET depth by 2.00' @ 6.20 hrs

Inflow Area = 305,034 sf, 0.00% Impervious, Inflow Depth = 0.40"  
 Inflow = 2.70 cfs @ 3.36 hrs, Volume= 10,047 cf  
 Outflow = 0.29 cfs @ 6.21 hrs, Volume= 411 cf, Atten= 89%, Lag= 170.9 min  
 Primary = 0.29 cfs @ 6.21 hrs, Volume= 411 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Starting Elev= 5,506.40' Surf.Area= 5,499 sf Storage= 26,424 cf

Peak Elev= 5,508.11' @ 6.21 hrs Surf.Area= 6,566 sf Storage= 36,065 cf (9,641 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 152.4 min ( 396.6 - 244.3 )

| Volume | Invert    | Avail.Storage | Storage Description                               |
|--------|-----------|---------------|---|
| #1     | 5,498.23' | 36,065 cf     | <b>17.00'W x 78.00'L x 9.77'H Prismatic Z=2.0</b> |

| Device | Routing | Invert    | Outlet Devices   |
|--------|---------|-----------|--|
| #1     | Primary | 5,508.00' | <b>3.0' long x 2.0' breadth Broad-Crested Rectangular Weir</b>         |
|        |         |           | Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50     |
|        |         |           | 3.00 3.50  |
|        |         |           | Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 |
|        |         |           | 3.20 3.32  |

Primary OutFlow Max=0.24 cfs @ 6.21 hrs HW=5,508.10' (Free Discharge)

1=Broad-Crested Rectangular Weir (Weir Controls 0.24 cfs @ 0.81 fps)

**25yr-6hr West Pond**

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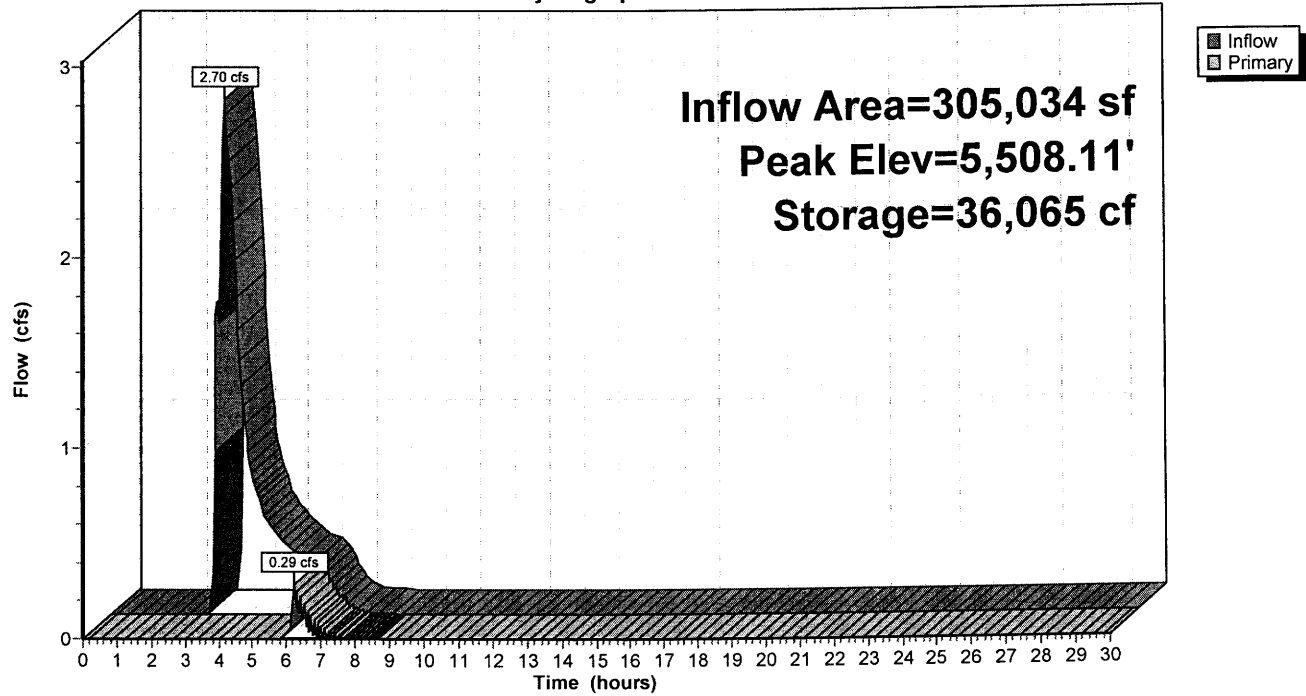
Type II 24-hr 6.00 hrs Rainfall=1.29"

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**Pond WP: West Sed Pond**

Hydrograph

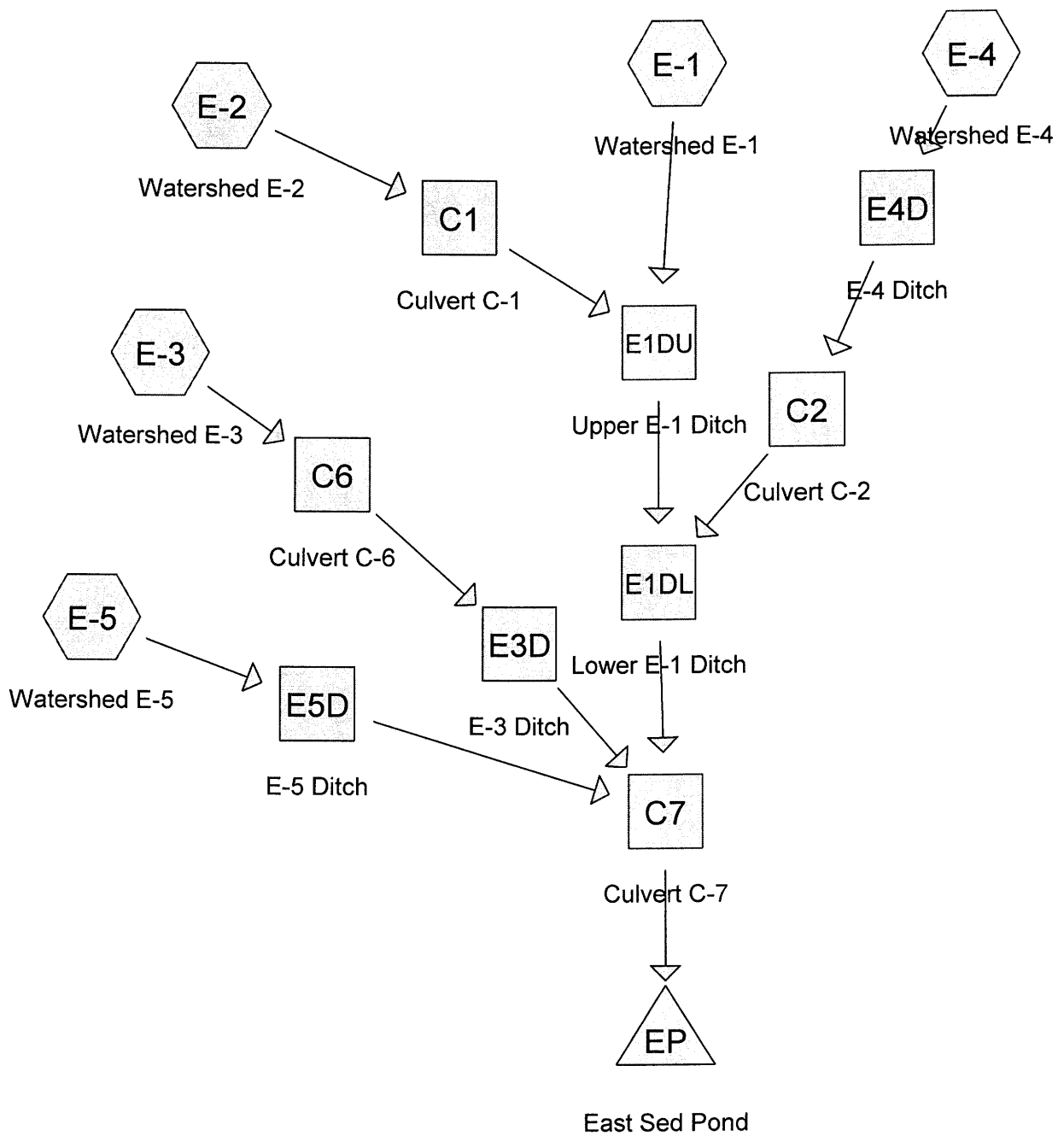


COVOL Engineered Fuels, LC  
| Dry-Coal Cleaning Facility

Permit Application  
July 2009 Revised September 2010

## **APPENDIX 7-8**

Drainage Channel and Culvert  
Hydrology Calculations



#### Drainage Diagram for 100yr-6hr East Pond

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**100yr-6hr East Pond**

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**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN | Description<br>(subcatchment-numbers) |
|-----------------|----|---------------------------------------|
| <b>759,267</b>  | 87 | (E-1,E-2,E-3,E-4,E-5)                 |
| 759,267         |    | <b>TOTAL AREA</b>                     |

**100yr-6hr East Pond**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 0               | HSG A         |                         |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| <b>759,267</b>  | Other         | E-1, E-2, E-3, E-4, E-5 |
| <b>759,267</b>  |               | <b>TOTAL AREA</b>       |

**100yr-6hr East Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E-1: Watershed E-1** Runoff Area=88,103 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=1,752' Slope=0.0210 '/' Tc=27.1 min CN=87 Runoff=1.88 cfs 5,195 cf

**Subcatchment E-2: Watershed E-2** Runoff Area=66,123 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=581' Slope=0.0210 '/' Tc=11.2 min CN=87 Runoff=2.70 cfs 3,899 cf

**Subcatchment E-3: Watershed E-3** Runoff Area=289,991 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=1,091' Slope=0.0300 '/' Tc=15.5 min CN=87 Runoff=9.41 cfs 17,098 cf

**Subcatchment E-4: Watershed E-4** Runoff Area=29,947 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=561' Slope=0.2500 '/' Tc=3.2 min CN=87 Runoff=2.20 cfs 1,766 cf

**Subcatchment E-5: Watershed E-5** Runoff Area=285,103 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=925' Slope=0.0250 '/' Tc=14.9 min CN=87 Runoff=9.49 cfs 16,810 cf

**Reach C1: Culvert C-1** Avg. Depth=0.49' Max Vel=5.39 fps Inflow=2.70 cfs 3,899 cf  
D=18.0" n=0.020 L=40.0' S=0.0300 '/' Capacity=11.83 cfs Outflow=2.68 cfs 3,899 cf

**Reach C2: Culvert C-2** Avg. Depth=0.34' Max Vel=4.20 fps Inflow=1.27 cfs 1,766 cf  
D=18.0" n=0.020 L=40.0' S=0.0275 '/' Capacity=11.32 cfs Outflow=1.24 cfs 1,769 cf

**Reach C6: Culvert C-6** Avg. Depth=1.50' Max Vel=5.26 fps Inflow=9.41 cfs 17,098 cf  
D=18.0" n=0.025 L=200.0' S=0.0225 '/' Capacity=8.19 cfs Outflow=8.50 cfs 17,098 cf

**Reach C7: Culvert C-7** Avg. Depth=1.10' Max Vel=13.53 fps Inflow=18.87 cfs 44,770 cf  
D=18.0" n=0.025 L=20.0' S=0.1500 '/' Capacity=21.16 cfs Outflow=18.86 cfs 44,770 cf

**Reach E1DL: Lower E-1 Ditch** Avg. Depth=0.89' Max Vel=2.87 fps Inflow=3.44 cfs 10,862 cf  
n=0.035 L=287.0' S=0.0171 '/' Capacity=13.67 cfs Outflow=3.40 cfs 10,862 cf

**Reach E1DU: Upper E-1 Ditch** Avg. Depth=1.06' Max Vel=2.70 fps Inflow=3.37 cfs 9,093 cf  
n=0.035 L=720.0' S=0.0150 '/' Capacity=7.67 cfs Outflow=3.02 cfs 9,093 cf

**Reach E3D: E-3 Ditch** Avg. Depth=1.02' Max Vel=3.70 fps Inflow=8.50 cfs 17,098 cf  
n=0.035 L=283.0' S=0.0194 '/' Capacity=21.95 cfs Outflow=8.44 cfs 17,098 cf

**Reach E4D: E-4 Ditch** Avg. Depth=0.65' Max Vel=2.22 fps Inflow=2.20 cfs 1,766 cf  
n=0.035 L=561.0' S=0.0159 '/' Capacity=7.21 cfs Outflow=1.27 cfs 1,766 cf

**Reach E5D: E-5 Ditch** Avg. Depth=0.91' Max Vel=2.35 fps Inflow=9.49 cfs 16,810 cf  
n=0.035 L=746.0' S=0.0091 '/' Capacity=10.01 cfs Outflow=7.79 cfs 16,810 cf

**Pond EP: East Sed Pond** Peak Elev=5,502.54' Storage=44,769 cf Inflow=18.86 cfs 44,770 cf  
Outflow=0.00 cfs 0 cf

**Total Runoff Area = 759,267 sf Runoff Volume = 44,768 cf Average Runoff Depth = 0.71"**  
**100.00% Pervious = 759,267 sf 0.00% Impervious = 0 sf**

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment E-1: Watershed E-1**

Runoff = 1.88 cfs @ 3.33 hrs, Volume= 5,195 cf, Depth= 0.71"

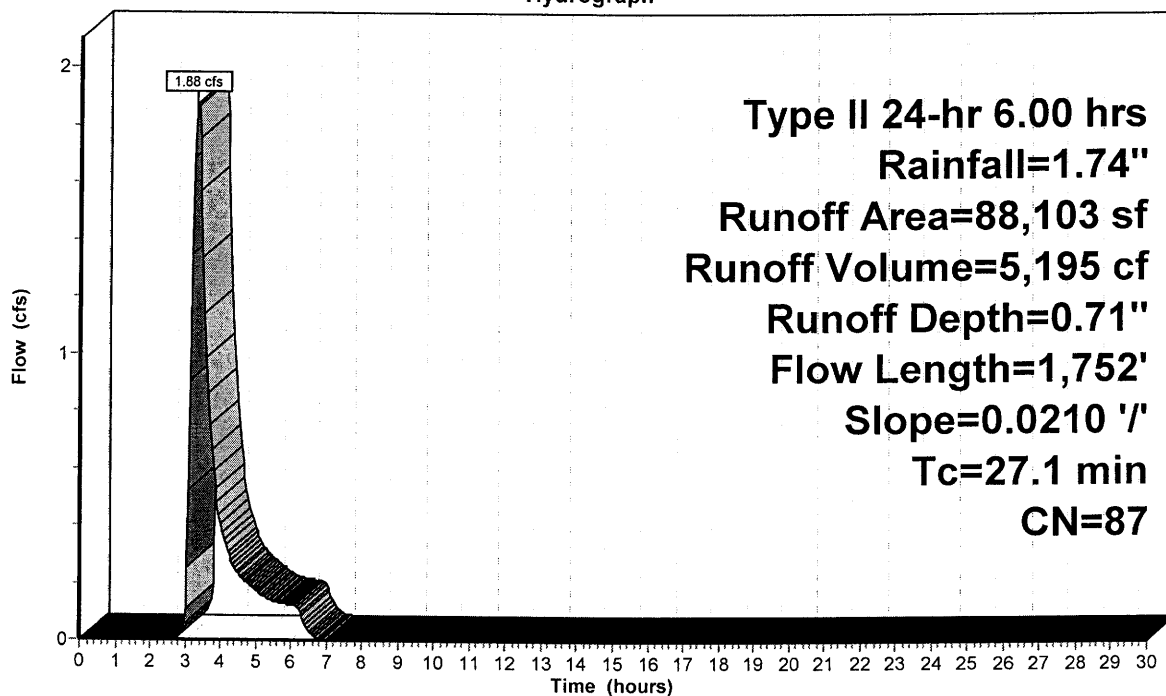
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 88,103    | 87 |               |
|   | 88,103    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 27.1        | 1,752            | 0.0210           | 1.08                 |                   | Lag/CN Method, |

**Subcatchment E-1: Watershed E-1**

Hydrograph



Runoff

**100yr-6hr East Pond**

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**Summary for Subcatchment E-2: Watershed E-2**

Runoff = 2.70 cfs @ 3.12 hrs, Volume= 3,899 cf, Depth= 0.71"

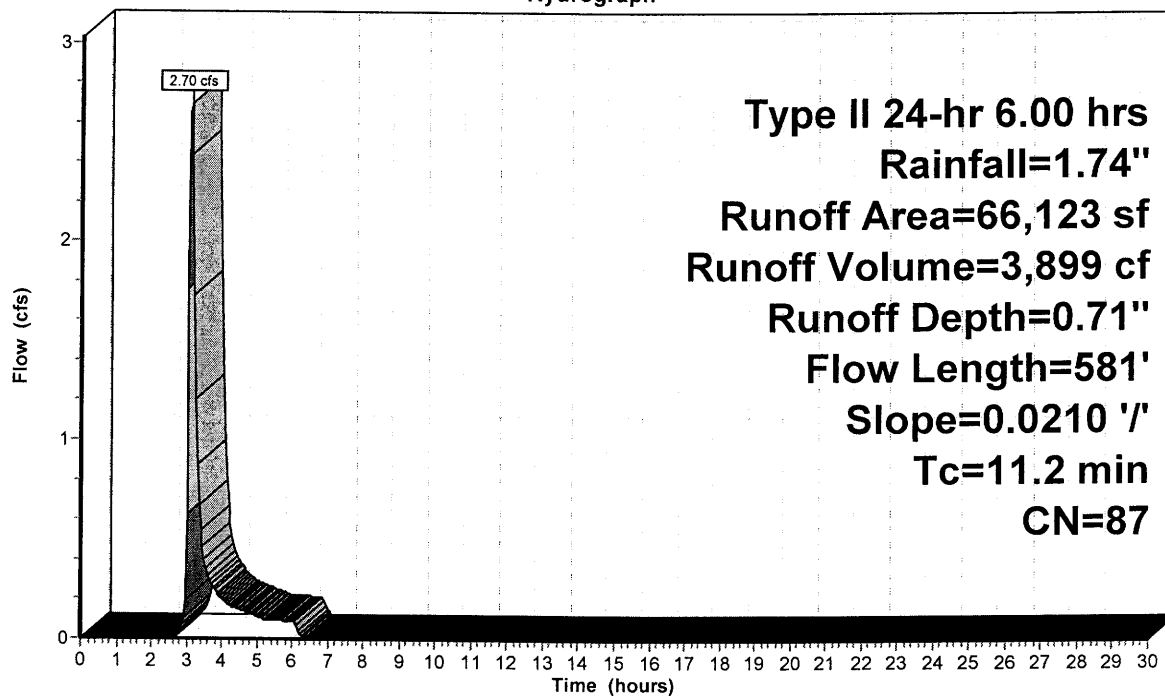
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 66,123    | 87 |               |
|   | 66,123    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 11.2        | 581              | 0.0210           | 0.86                 |                   | Lag/CN Method, |

**Subcatchment E-2: Watershed E-2**

Hydrograph



**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment E-3: Watershed E-3**

Runoff = 9.41 cfs @ 3.17 hrs, Volume= 17,098 cf, Depth= 0.71"

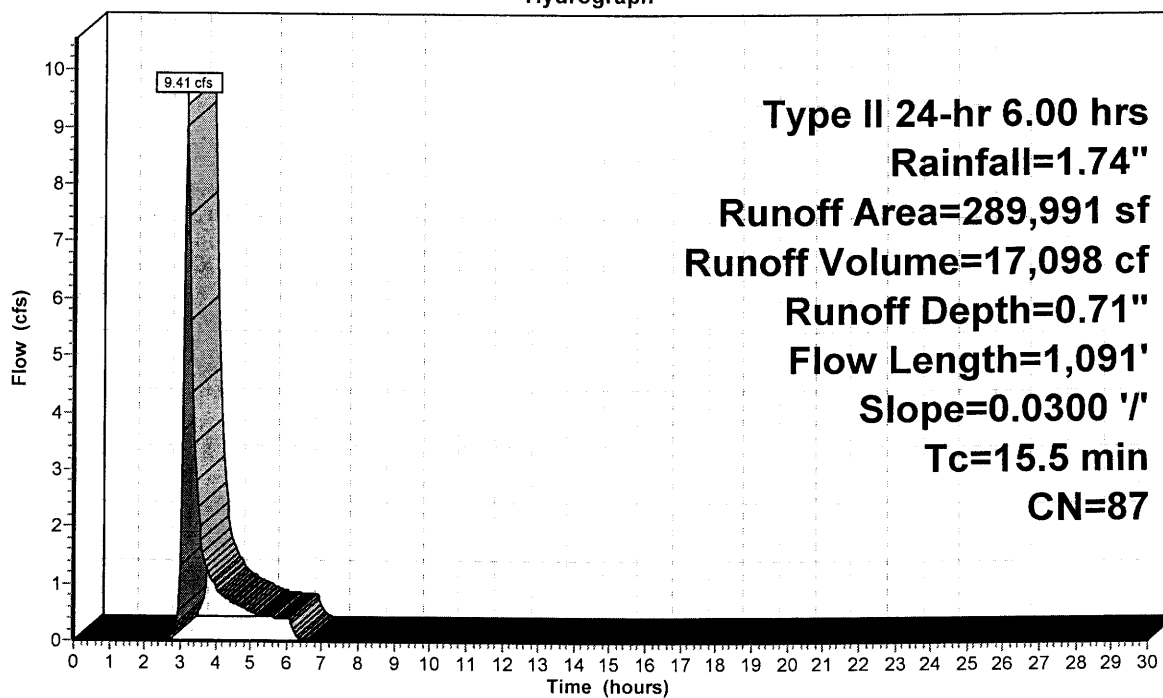
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 289,991   | 87 |               |
|   | 289,991   |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 15.5        | 1,091            | 0.0300           | 1.17                 |                   | Lag/CN Method, |

**Subcatchment E-3: Watershed E-3**

Hydrograph



Runoff

**100yr-6hr East Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment E-4: Watershed E-4**[49] Hint:  $T_c < 2dt$  may require smaller  $dt$ 

Runoff = 2.20 cfs @ 3.01 hrs, Volume= 1,766 cf, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs,  $dt=0.05$  hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

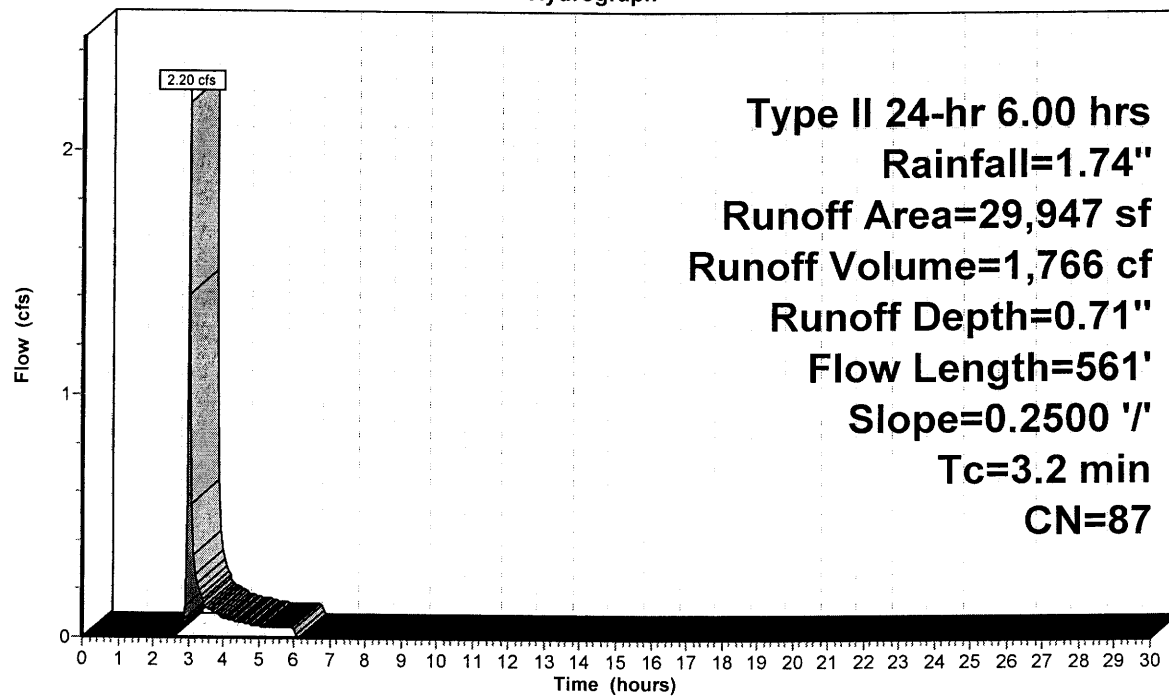
|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 29,947    | 87 |               |
|   | 29,947    |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 3.2      | 561           | 0.2500        | 2.96              |                | Lag/CN Method, |

**Subcatchment E-4: Watershed E-4**

Hydrograph



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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment E-5: Watershed E-5**

Runoff = 9.49 cfs @ 3.16 hrs, Volume= 16,810 cf, Depth= 0.71"

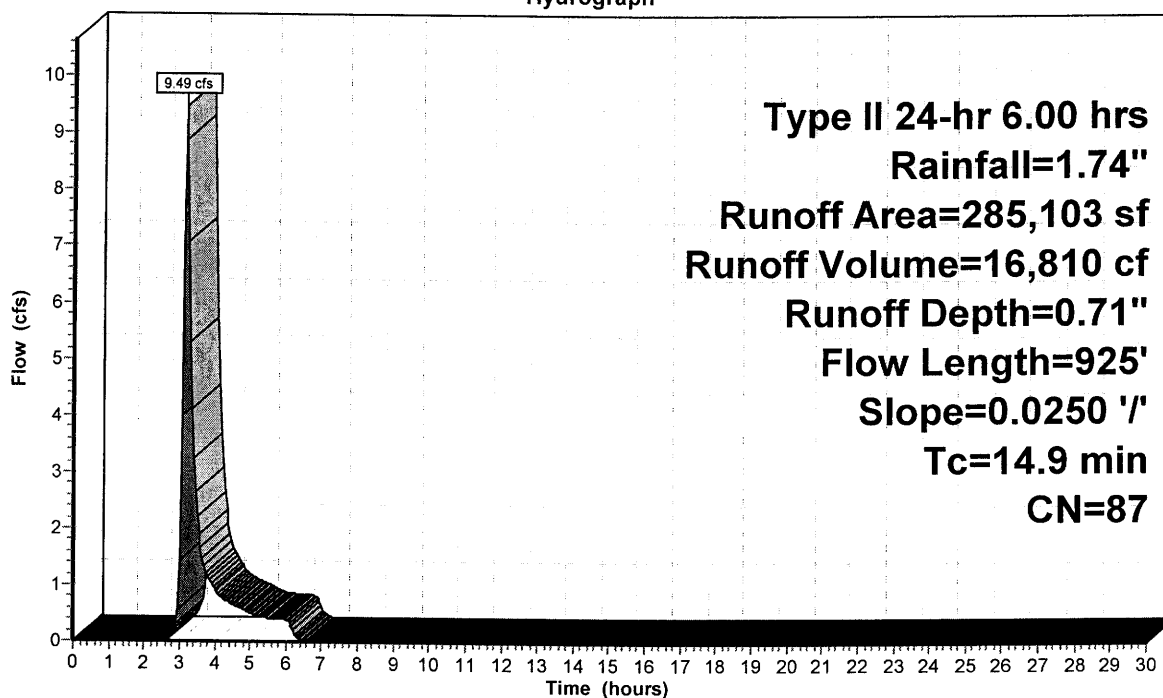
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 285,103   | 87 |               |
|   | 285,103   |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 14.9        | 925              | 0.0250           | 1.04                 |                   | Lag/CN Method, |

**Subcatchment E-5: Watershed E-5**

Hydrograph





**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C1: Culvert C-1**

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 66,123 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 2.70 cfs @ 3.12 hrs, Volume= 3,899 cf  
 Outflow = 2.68 cfs @ 3.12 hrs, Volume= 3,899 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 5.39 fps, Min. Travel Time= 0.1 min

Avg. Velocity= 2.26 fps, Avg. Travel Time= 0.3 min

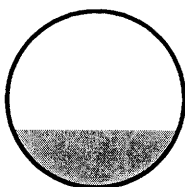
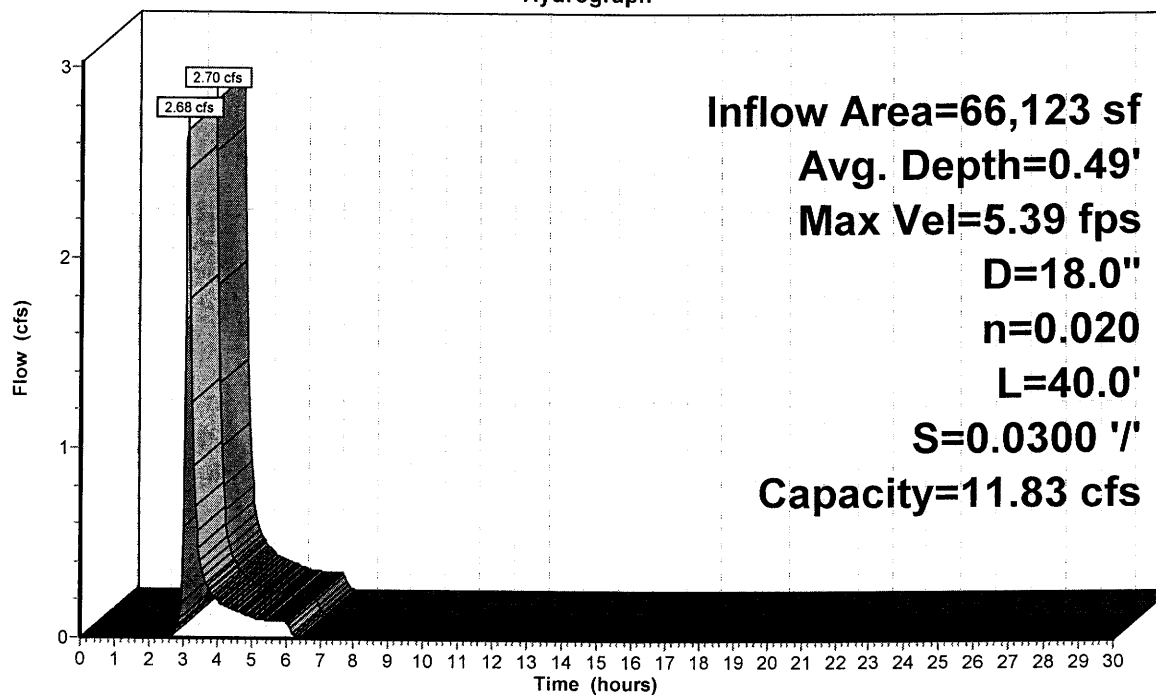
Peak Storage= 20 cf @ 3.12 hrs, Average Depth at Peak Storage= 0.49'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.83 cfs

18.0" Diameter Pipe, n= 0.020 Corrugated PE, corrugated interior

Length= 40.0' Slope= 0.0300 '/'

Inlet Invert= 5,520.70', Outlet Invert= 5,519.50'

**Reach C1: Culvert C-1****Hydrograph**

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C2: Culvert C-2**

[52] Hint: Inlet/Outlet conditions not evaluated

[61] Hint: Exceeded Reach E4D outlet invert by 0.33' @ 3.15 hrs

Inflow Area = 29,947 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 1.27 cfs @ 3.13 hrs, Volume= 1,766 cf  
 Outflow = 1.24 cfs @ 3.14 hrs, Volume= 1,769 cf, Atten= 2%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2

Max. Velocity= 4.20 fps, Min. Travel Time= 0.2 min

Avg. Velocity= 1.42 fps, Avg. Travel Time= 0.5 min

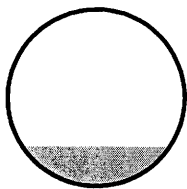
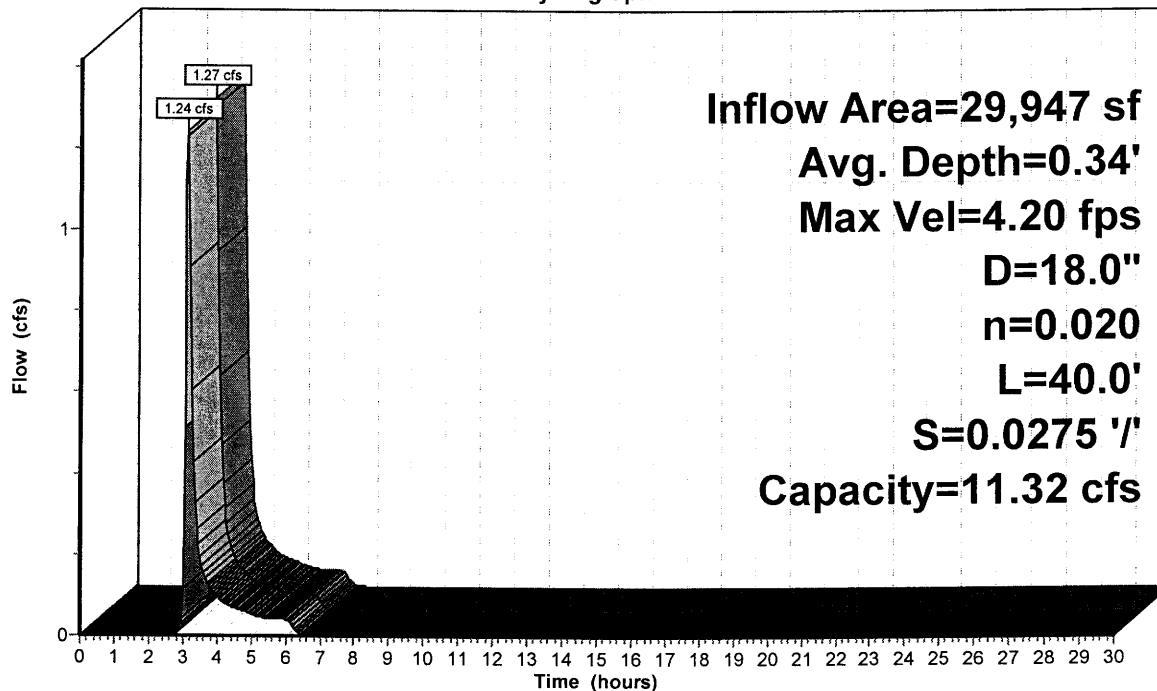
Peak Storage= 12 cf @ 3.13 hrs, Average Depth at Peak Storage= 0.34'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.32 cfs

18.0" Diameter Pipe, n= 0.020 Corrugated PE, corrugated interior

Length= 40.0' Slope= 0.0275 '/'

Inlet Invert= 5,509.80', Outlet Invert= 5,508.70'

**Reach C2: Culvert C-2****Hydrograph**

■ Inflow  
 □ Outflow

**100yr-6hr East Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C6: Culvert C-6**

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 115% of Manning's capacity

[76] Warning: Detained 202 cf (Pond w/culvert advised)

Inflow Area = 289,991 sf, 0.00% Impervious, Inflow Depth = 0.71"  
Inflow = 9.41 cfs @ 3.17 hrs, Volume= 17,098 cf  
Outflow = 8.50 cfs @ 3.25 hrs, Volume= 17,098 cf, Atten= 10%, Lag= 4.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 5.26 fps, Min. Travel Time= 0.6 min

Avg. Velocity = 2.39 fps, Avg. Travel Time= 1.4 min

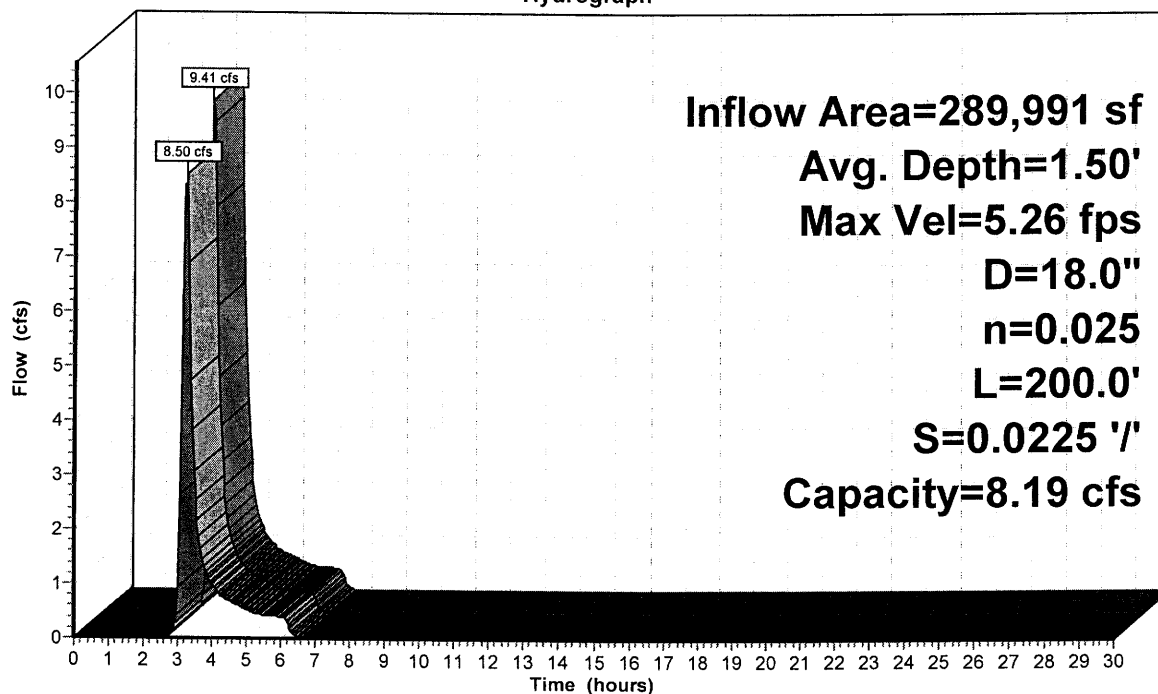
Peak Storage= 354 cf @ 3.19 hrs, Average Depth at Peak Storage= 1.50'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 8.19 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

Length= 200.0' Slope= 0.0225 '/'

Inlet Invert= 5,514.00', Outlet Invert= 5,509.50'

**Reach C6: Culvert C-6****Hydrograph**

Inflow  
Outflow

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C7: Culvert C-7**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach E1DL OUTLET depth by 1.41' @ 3.30 hrs

[62] Warning: Exceeded Reach E3D OUTLET depth by 1.19' @ 3.35 hrs

[62] Warning: Exceeded Reach E5D OUTLET depth by 1.43' @ 3.30 hrs

Inflow Area = 759,267 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 18.87 cfs @ 3.30 hrs, Volume= 44,770 cf  
 Outflow = 18.86 cfs @ 3.30 hrs, Volume= 44,770 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 13.53 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 4.32 fps, Avg. Travel Time= 0.1 min

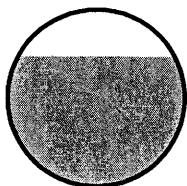
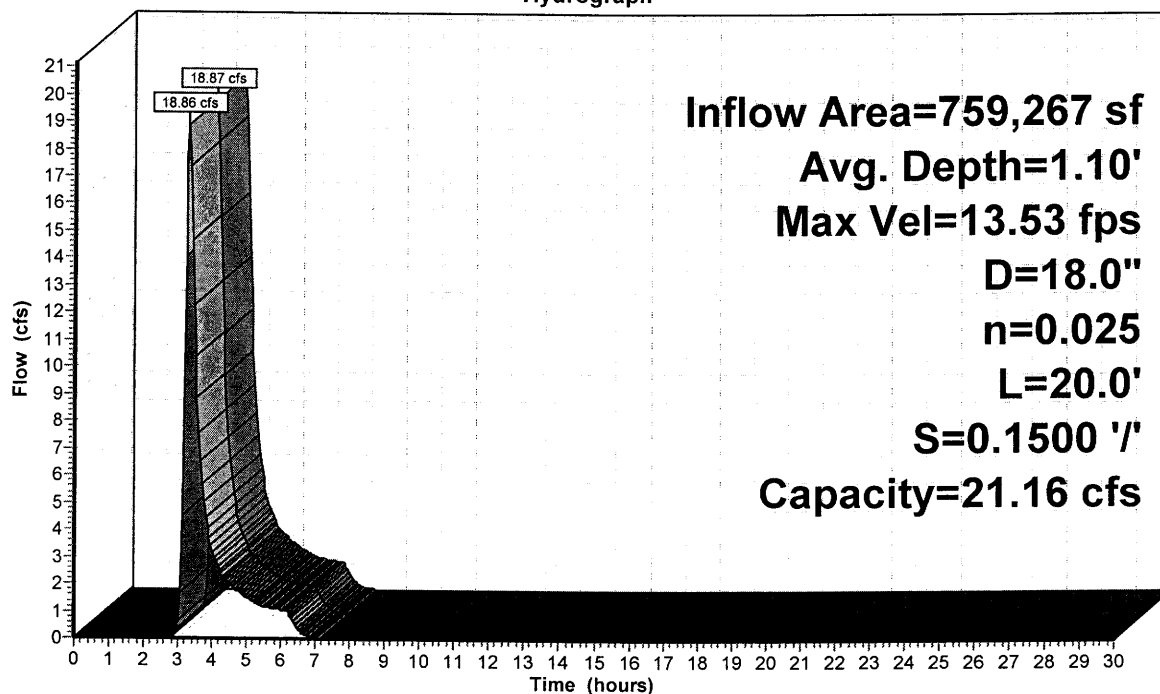
Peak Storage= 28 cf @ 3.30 hrs, Average Depth at Peak Storage= 1.10'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 21.16 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

Length= 20.0' Slope= 0.1500 '/'

Inlet Invert= 5,505.00', Outlet Invert= 5,502.00'

**Reach C7: Culvert C-7****Hydrograph**

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach E1DL: Lower E-1 Ditch**

[62] Warning: Exceeded Reach C2 OUTLET depth by 0.71' @ 3.35 hrs

[61] Hint: Exceeded Reach E1DU outlet invert by 0.89' @ 3.30 hrs

Inflow Area = 184,173 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 3.44 cfs @ 3.28 hrs, Volume= 10,862 cf  
 Outflow = 3.40 cfs @ 3.34 hrs, Volume= 10,862 cf, Atten= 1%, Lag= 3.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.87 fps, Min. Travel Time= 1.7 min

Avg. Velocity= 0.98 fps, Avg. Travel Time= 4.9 min

Peak Storage= 344 cf @ 3.31 hrs, Average Depth at Peak Storage= 0.89'

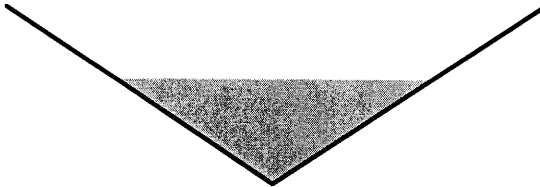
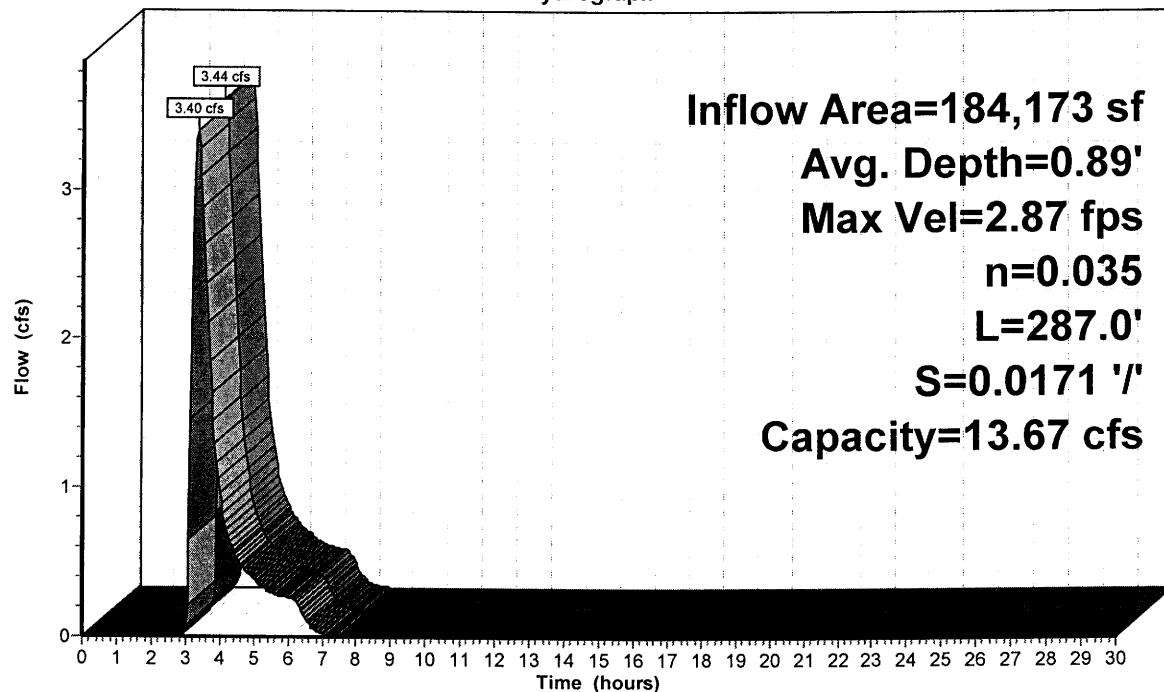
Bank-Full Depth= 1.50', Capacity at Bank-Full= 13.67 cfs

0.00' x 1.50' deep channel, n= 0.035

Side Slope Z-value= 1.5 ' ' Top Width= 4.50'

Length= 287.0' Slope= 0.0171 ' '

Inlet Invert= 5,508.70', Outlet Invert= 5,503.80'

**Reach E1DL: Lower E-1 Ditch****Hydrograph**

■ Inflow  
 ■ Outflow

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach E1DU: Upper E-1 Ditch**

[62] Warning: Exceeded Reach C1 OUTLET depth by 0.78' @ 3.35 hrs

Inflow Area = 154,226 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 3.37 cfs @ 3.15 hrs, Volume= 9,093 cf  
 Outflow = 3.02 cfs @ 3.32 hrs, Volume= 9,093 cf, Atten= 10%, Lag= 10.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.70 fps, Min. Travel Time= 4.4 min

Avg. Velocity = 0.94 fps, Avg. Travel Time= 12.7 min

Peak Storage= 806 cf @ 3.23 hrs, Average Depth at Peak Storage= 1.06'

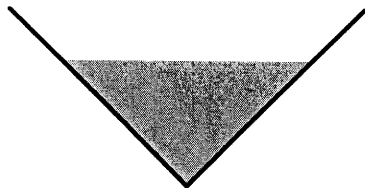
Bank-Full Depth= 1.50', Capacity at Bank-Full= 7.67 cfs

0.00' x 1.50' deep channel, n= 0.035

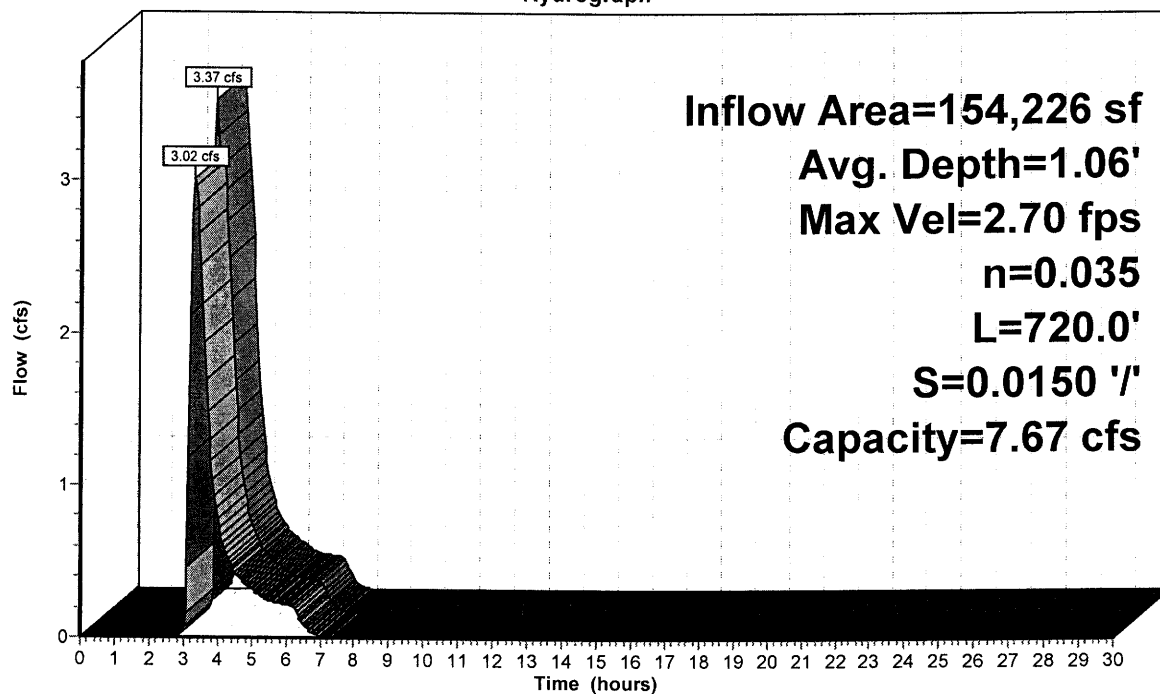
Side Slope Z-value= 1.0 ' Top Width= 3.00'

Length= 720.0' Slope= 0.0150 '/'

Inlet Invert= 5,519.50', Outlet Invert= 5,508.70'

**Reach E1DU: Upper E-1 Ditch**

Hydrograph



■ Inflow  
 ■ Outflow

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach E3D: E-3 Ditch**

[62] Warning: Exceeded Reach C6 OUTLET depth by 0.07' @ 3.35 hrs

Inflow Area = 289,991 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 8.50 cfs @ 3.25 hrs, Volume= 17,098 cf  
 Outflow = 8.44 cfs @ 3.25 hrs, Volume= 17,098 cf, Atten= 1%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.70 fps, Min. Travel Time= 1.3 min

Avg. Velocity = 1.52 fps, Avg. Travel Time= 3.1 min

Peak Storage= 656 cf @ 3.22 hrs, Average Depth at Peak Storage= 1.02'

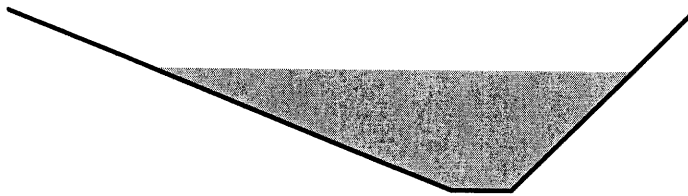
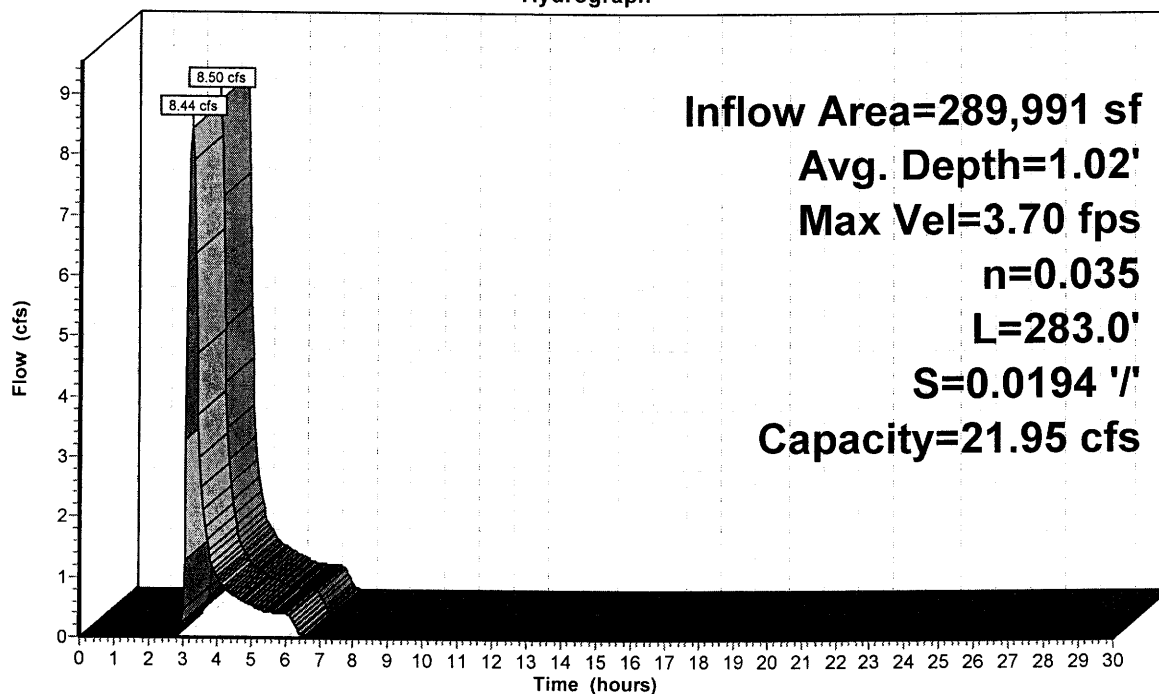
Bank-Full Depth= 1.50', Capacity at Bank-Full= 21.95 cfs

0.50' x 1.50' deep channel, n= 0.035

Side Slope Z-value= 2.5 1.0 ' / ' Top Width= 5.75'

Length= 283.0' Slope= 0.0194 ' / '

Inlet Invert= 5,509.50', Outlet Invert= 5,504.00'

**Reach E3D: E-3 Ditch****Hydrograph**

■ Inflow  
 ■ Outflow

**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach E4D: E-4 Ditch**

Inflow Area = 29,947 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 2.20 cfs @ 3.01 hrs, Volume= 1,766 cf  
 Outflow = 1.27 cfs @ 3.13 hrs, Volume= 1,766 cf, Atten= 42%, Lag= 7.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.22 fps, Min. Travel Time= 4.2 min

Avg. Velocity= 0.71 fps, Avg. Travel Time= 13.2 min

Peak Storage= 359 cf @ 3.06 hrs, Average Depth at Peak Storage= 0.65'

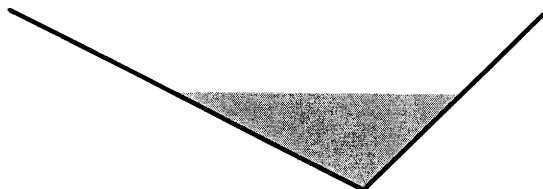
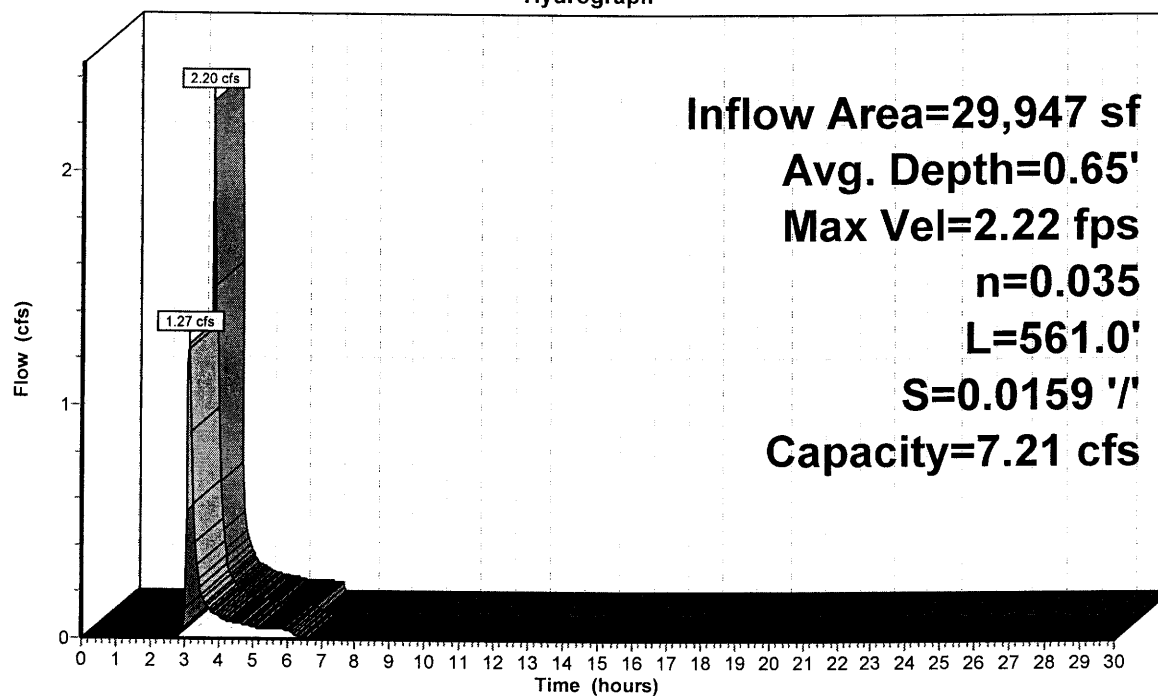
Bank-Full Depth= 1.20', Capacity at Bank-Full= 7.21 cfs

0.00' x 1.20' deep channel, n= 0.035

Side Slope Z-value= 2.0 1.0 '/' Top Width= 3.60'

Length= 561.0' Slope= 0.0159 '/'

Inlet Invert= 5,518.70', Outlet Invert= 5,509.80'

**Reach E4D: E-4 Ditch****Hydrograph**

■ Inflow  
 ■ Outflow



**100yr-6hr East Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach E5D: E-5 Ditch**

Inflow Area = 285,103 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 9.49 cfs @ 3.16 hrs, Volume= 16,810 cf  
 Outflow = 7.79 cfs @ 3.32 hrs, Volume= 16,810 cf, Atten= 18%, Lag= 9.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.35 fps, Min. Travel Time= 5.3 min

Avg. Velocity= 0.60 fps, Avg. Travel Time= 20.8 min

Peak Storage= 2,486 cf @ 3.24 hrs, Average Depth at Peak Storage= 0.91'

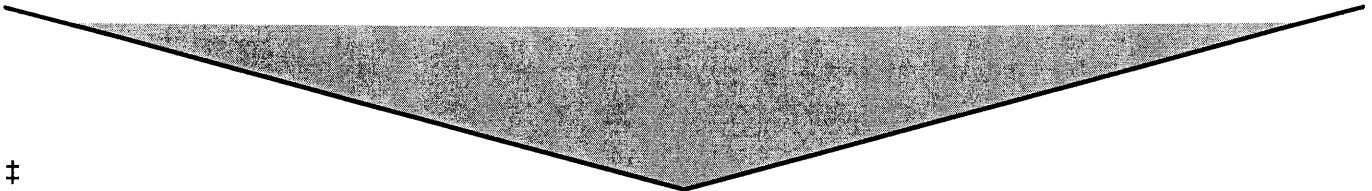
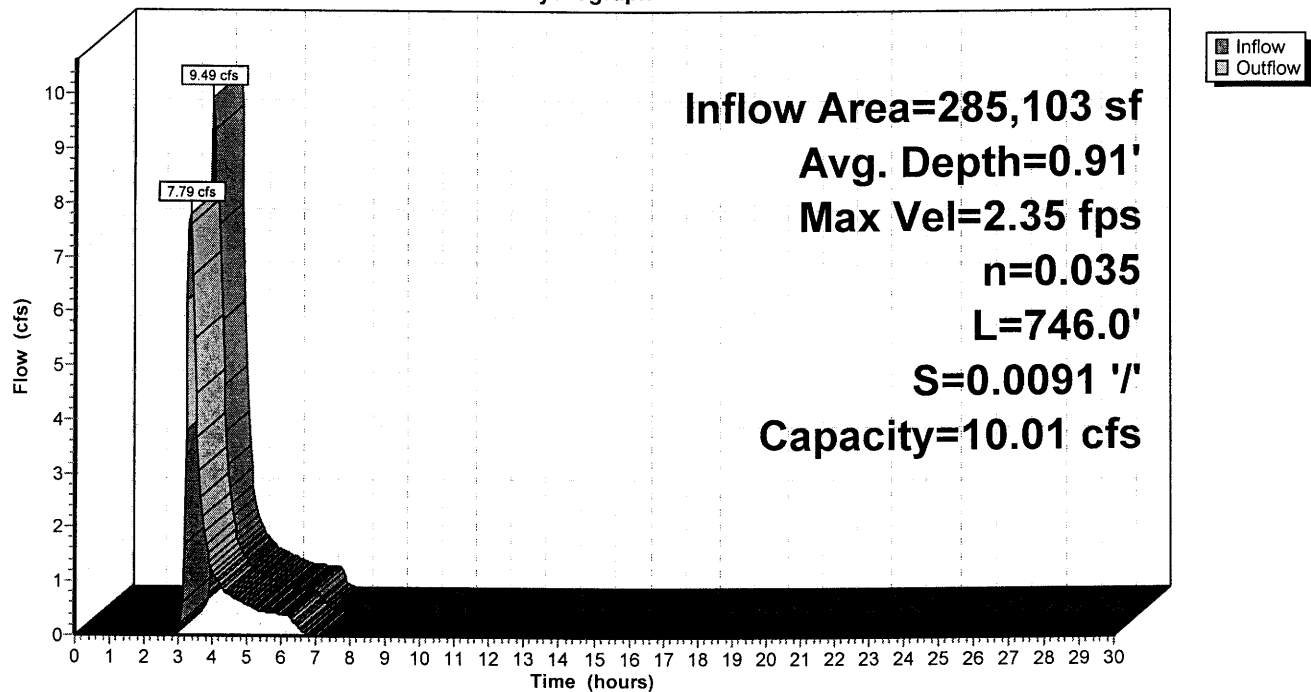
Bank-Full Depth= 1.00', Capacity at Bank-Full= 10.01 cfs

0.00' x 1.00' deep channel, n= 0.035

Side Slope Z-value= 4.0 ' Top Width= 8.00'

Length= 746.0' Slope= 0.0091 ' /'

Inlet Invert= 5,510.60', Outlet Invert= 5,503.80'

**Reach E5D: E-5 Ditch****Hydrograph**

**100yr-6hr East Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Pond EP: East Sed Pond**

[62] Warning: Exceeded Reach C7 OUTLET depth by 0.54' @ 29.95 hrs

Inflow Area = 759,267 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 18.86 cfs @ 3.30 hrs, Volume= 44,770 cf  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2  
 Peak Elev= 5,502.54' @ 30.00 hrs Surf.Area= 8,833 sf Storage= 44,769 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

| Volume | Invert    | Avail.Storage | Storage Description  |
|--------|-----------|---------------|--|
| #1     | 5,493.80' | 56,820 cf     | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 5,493.80            | 2,550                | 0                         | 0                         |
| 5,494.80            | 2,601                | 2,576                     | 2,576                     |
| 5,495.80            | 3,214                | 2,908                     | 5,483                     |
| 5,496.80            | 3,909                | 3,562                     | 9,045                     |
| 5,497.80            | 4,637                | 4,273                     | 13,318                    |
| 5,498.80            | 5,425                | 5,031                     | 18,349                    |
| 5,499.80            | 6,243                | 5,834                     | 24,183                    |
| 5,500.80            | 7,158                | 6,701                     | 30,883                    |
| 5,501.80            | 8,125                | 7,642                     | 38,525                    |
| 5,502.80            | 9,087                | 8,606                     | 47,131                    |
| 5,503.80            | 10,291               | 9,689                     | 56,820                    |

**100yr-6hr East Pond**

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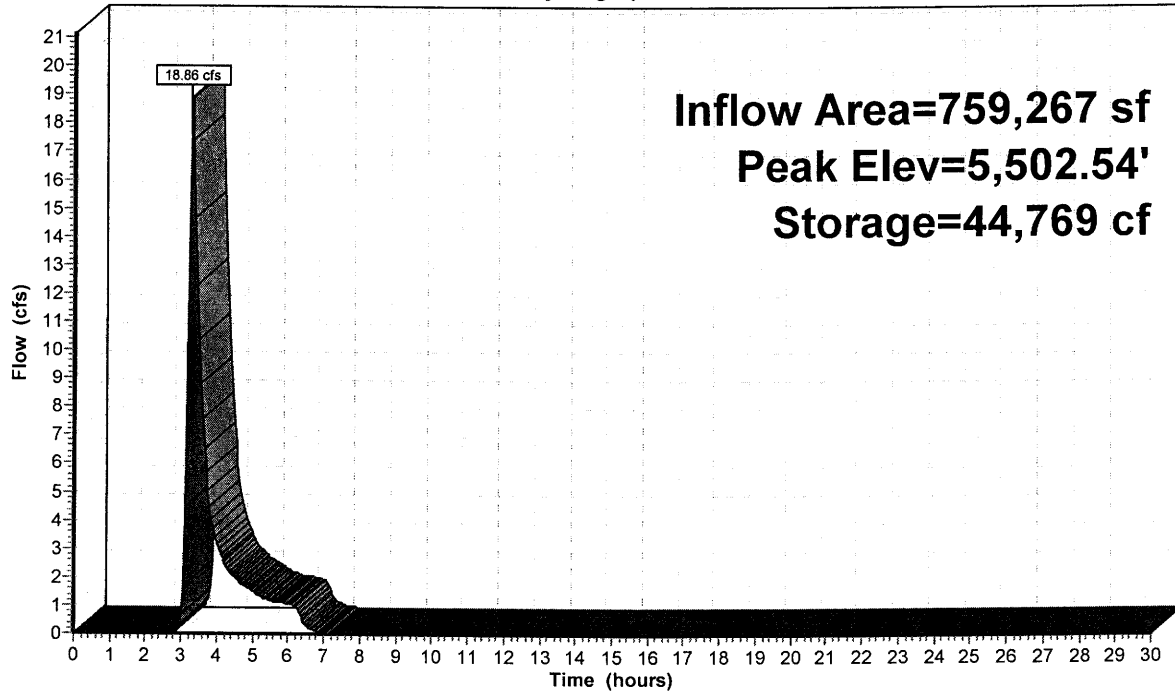
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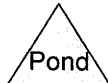
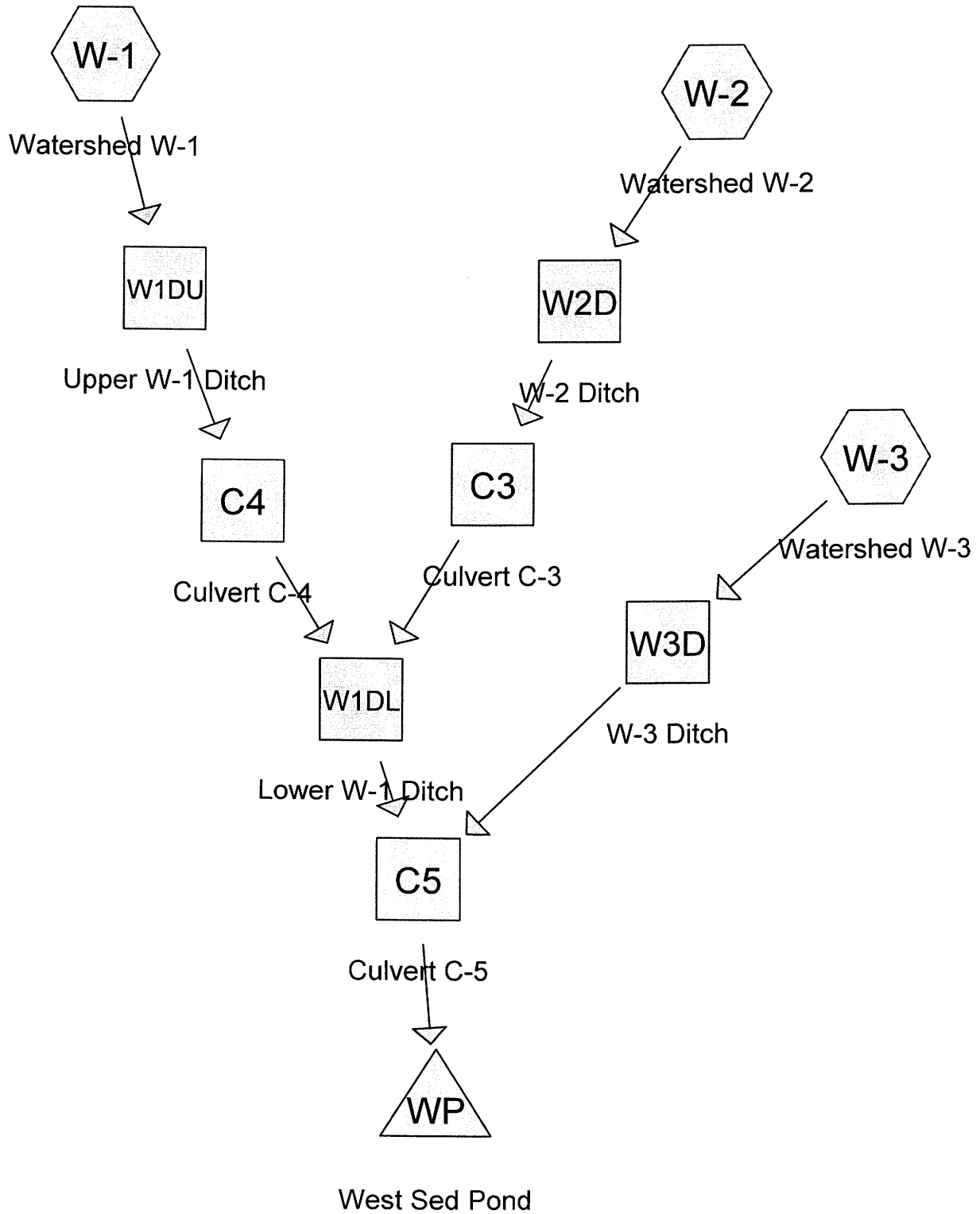
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**Pond EP: East Sed Pond**

Hydrograph



Inflow



#### Drainage Diagram for 100yr-6hr West Pond

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**100yr-6hr West Pond**

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Page 2

**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN | Description<br>(subcatchment-numbers) |
|-----------------|----|---------------------------------------|
| <b>305,034</b>  | 87 | (W-1,W-2,W-3)                         |
| 305,034         |    | <b>TOTAL AREA</b>                     |

**100yr-6hr West Pond**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 0               | HSG A         |                         |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| <b>305,034</b>  | Other         | W-1, W-2, W-3           |
| 305,034         |               | <b>TOTAL AREA</b>       |

**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment W-1: Watershed W-1** Runoff Area=105,474 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=1,297' Slope=0.0250 '/' Tc=19.5 min CN=87 Runoff=2.88 cfs 6,219 cf

**Subcatchment W-2: Watershed W-2** Runoff Area=128,724 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=635' Slope=0.0250 '/' Tc=11.0 min CN=87 Runoff=5.32 cfs 7,590 cf

**Subcatchment W-3: Watershed W-3** Runoff Area=70,836 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=447' Slope=0.0270 '/' Tc=8.0 min CN=87 Runoff=3.52 cfs 4,177 cf

**Reach C3: Culvert C-3** Avg. Depth=0.64' Max Vel=6.47 fps Inflow=4.68 cfs 7,590 cf  
D=18.0" n=0.020 L=40.0' S=0.0325 '/' Capacity=12.31 cfs Outflow=4.65 cfs 7,590 cf

**Reach C4: Culvert C-4** Avg. Depth=0.63' Max Vel=3.35 fps Inflow=2.37 cfs 6,219 cf  
D=18.0" n=0.025 L=80.0' S=0.0137 '/' Capacity=6.41 cfs Outflow=2.35 cfs 6,219 cf

**Reach C5: Culvert C-5** Avg. Depth=0.49' Max Vel=11.15 fps Inflow=5.67 cfs 17,985 cf  
D=18.0" n=0.025 L=20.0' S=0.1950 '/' Capacity=24.12 cfs Outflow=5.67 cfs 17,985 cf

**Reach W1DL: Lower W-1 Ditch** Avg. Depth=1.03' Max Vel=2.35 fps Inflow=5.01 cfs 13,809 cf  
n=0.035 L=320.0' S=0.0088 '/' Capacity=29.49 cfs Outflow=4.90 cfs 13,809 cf

**Reach W1DU: Upper W-1 Ditch** Avg. Depth=0.71' Max Vel=2.38 fps Inflow=2.88 cfs 6,219 cf  
n=0.035 L=963.0' S=0.0145 '/' Capacity=38.02 cfs Outflow=2.37 cfs 6,219 cf

**Reach W2D: W-2 Ditch** Avg. Depth=0.40' Max Vel=2.58 fps Inflow=5.32 cfs 7,590 cf  
n=0.035 L=500.0' S=0.0158 '/' Capacity=23.56 cfs Outflow=4.68 cfs 7,590 cf

**Reach W3D: W-3 Ditch** Avg. Depth=0.71' Max Vel=2.50 fps Inflow=3.52 cfs 4,177 cf  
n=0.035 L=160.0' S=0.0156 '/' Capacity=8.65 cfs Outflow=3.21 cfs 4,177 cf

**Pond WP: West Sed Pond** Peak Elev=5,504.70' Storage=17,985 cf Inflow=5.67 cfs 17,985 cf  
Outflow=0.00 cfs 0 cf

**Total Runoff Area = 305,034 sf Runoff Volume = 17,985 cf Average Runoff Depth = 0.71"**  
**100.00% Pervious = 305,034 sf 0.00% Impervious = 0 sf**

**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment W-1: Watershed W-1**

Runoff = 2.88 cfs @ 3.22 hrs, Volume= 6,219 cf, Depth= 0.71"

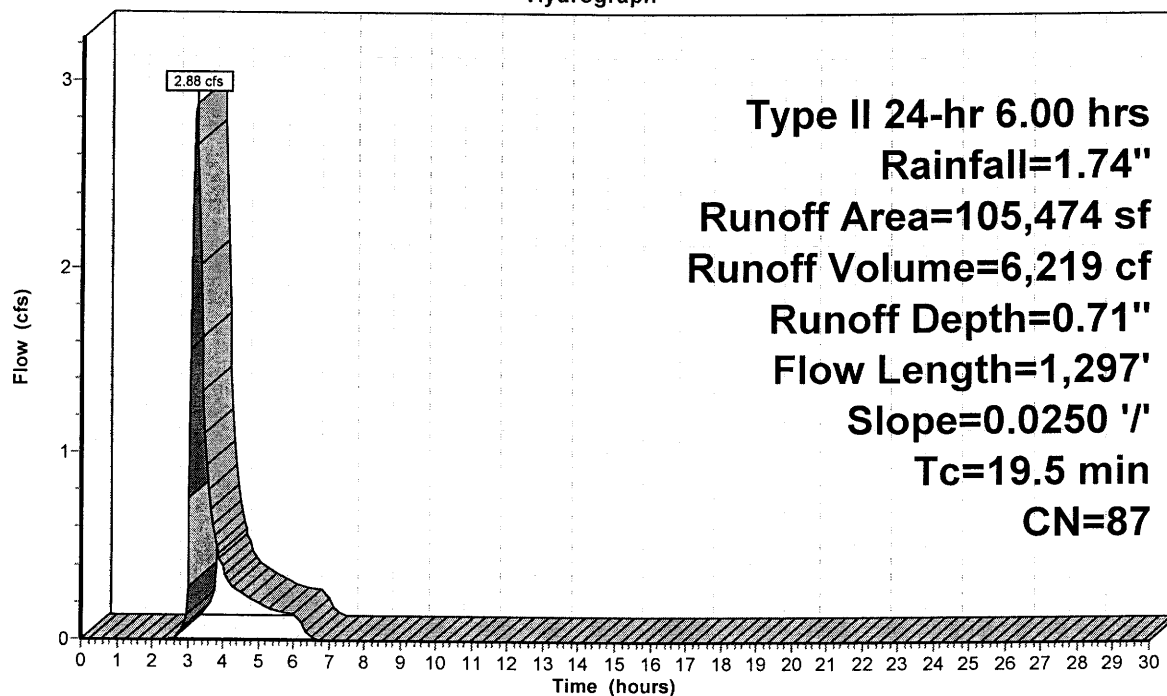
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 105,474   | 87 |               |
|   | 105,474   |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 19.5        | 1,297            | 0.0250           | 1.11                 |                   | Lag/CN Method, |

**Subcatchment W-1: Watershed W-1**

Hydrograph





**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment W-2: Watershed W-2**

Runoff = 5.32 cfs @ 3.11 hrs, Volume= 7,590 cf, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

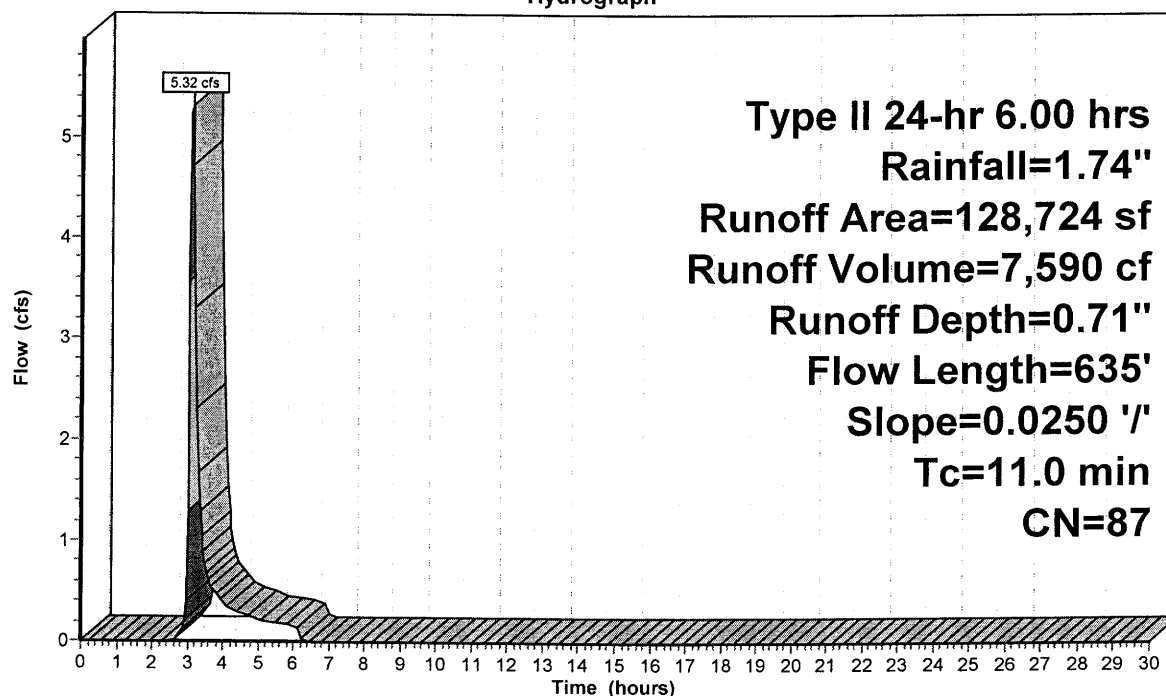
Type II 24-hr 6.00 hrs Rainfall=1.74"

| Area (sf) | CN | Description   |
|-----------|----|---------------|
| * 128,724 | 87 |               |
| 128,724   |    | Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description    |
|----------|---------------|---------------|-------------------|----------------|----------------|
| 11.0     | 635           | 0.0250        | 0.96              |                | Lag/CN Method, |

**Subcatchment W-2: Watershed W-2**

Hydrograph



Runoff

**100yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Subcatchment W-3: Watershed W-3**

Runoff = 3.52 cfs @ 3.07 hrs, Volume= 4,177 cf, Depth= 0.71"

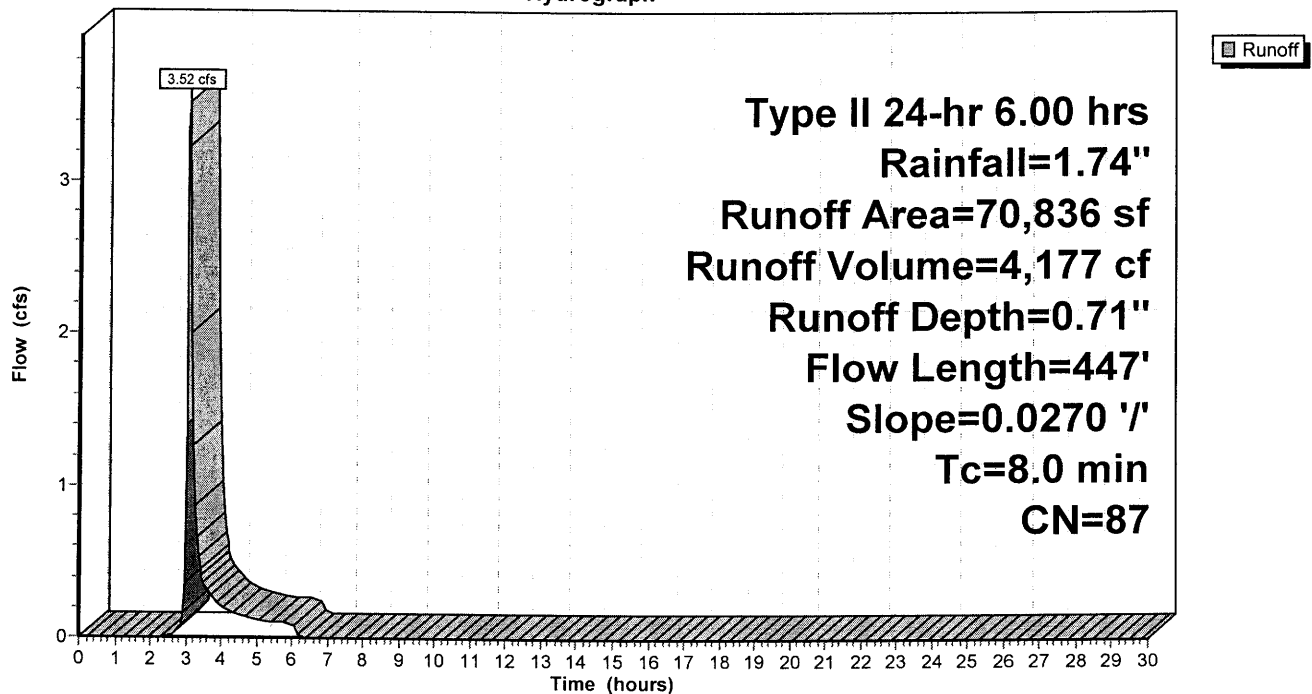
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr 6.00 hrs Rainfall=1.74"

|   | Area (sf) | CN | Description   |
|---|-----------|----|---------------|
| * | 70,836    | 87 |               |
|   | 70,836    |    | Pervious Area |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description    |
|-------------|------------------|------------------|----------------------|-------------------|----------------|
| 8.0         | 447              | 0.0270           | 0.93                 |                   | Lag/CN Method, |

**Subcatchment W-3: Watershed W-3**

Hydrograph



**100yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C3: Culvert C-3**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W2D OUTLET depth by 0.29' @ 3.25 hrs

Inflow Area = 128,724 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 4.68 cfs @ 3.21 hrs, Volume= 7,590 cf  
 Outflow = 4.65 cfs @ 3.21 hrs, Volume= 7,590 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 6.47 fps, Min. Travel Time= 0.1 min

Avg. Velocity = 1.96 fps, Avg. Travel Time= 0.3 min

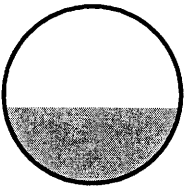
Peak Storage= 29 cf @ 3.21 hrs, Average Depth at Peak Storage= 0.64'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 12.31 cfs

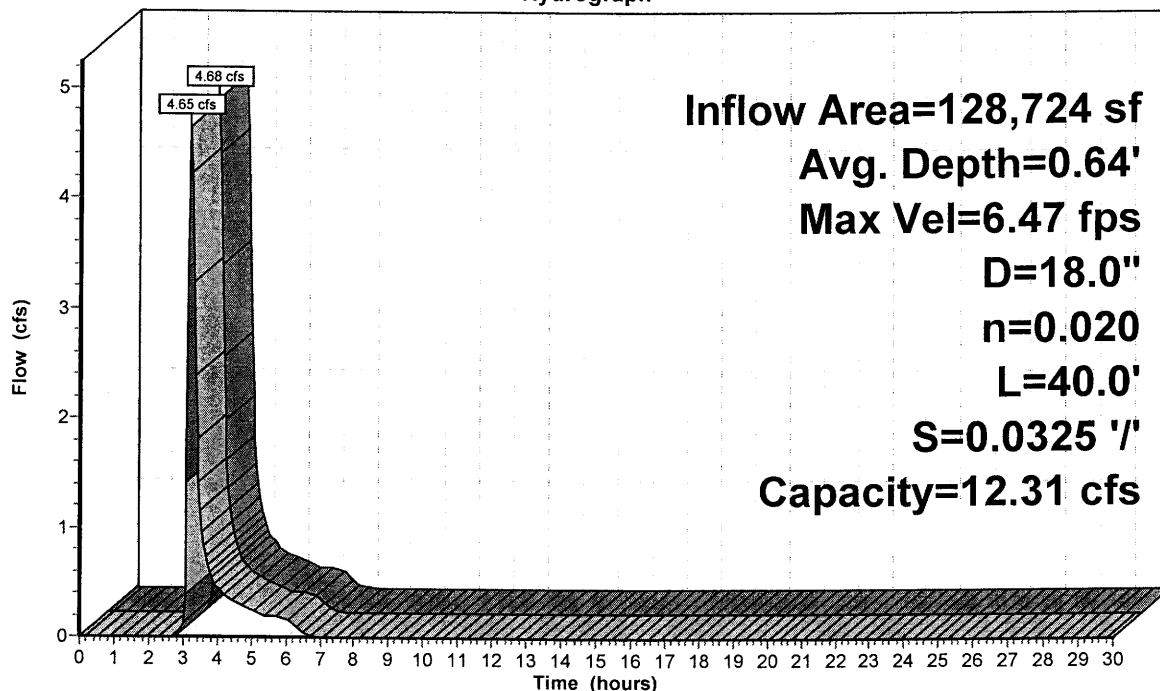
18.0" Diameter Pipe, n= 0.020

Length= 40.0' Slope= 0.0325 '/'

Inlet Invert= 5,512.10', Outlet Invert= 5,510.80'

**Reach C3: Culvert C-3**

Hydrograph



**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C4: Culvert C-4**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W1DU OUTLET depth by 1.20' @ 0.00 hrs

Inflow Area = 105,474 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 2.37 cfs @ 3.43 hrs, Volume= 6,219 cf  
 Outflow = 2.35 cfs @ 3.44 hrs, Volume= 6,219 cf, Atten= 1%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.35 fps, Min. Travel Time= 0.4 min

Avg. Velocity = 1.03 fps, Avg. Travel Time= 1.3 min

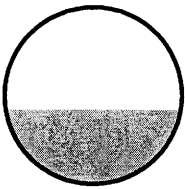
Peak Storage= 57 cf @ 3.43 hrs, Average Depth at Peak Storage= 0.63'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 6.41 cfs

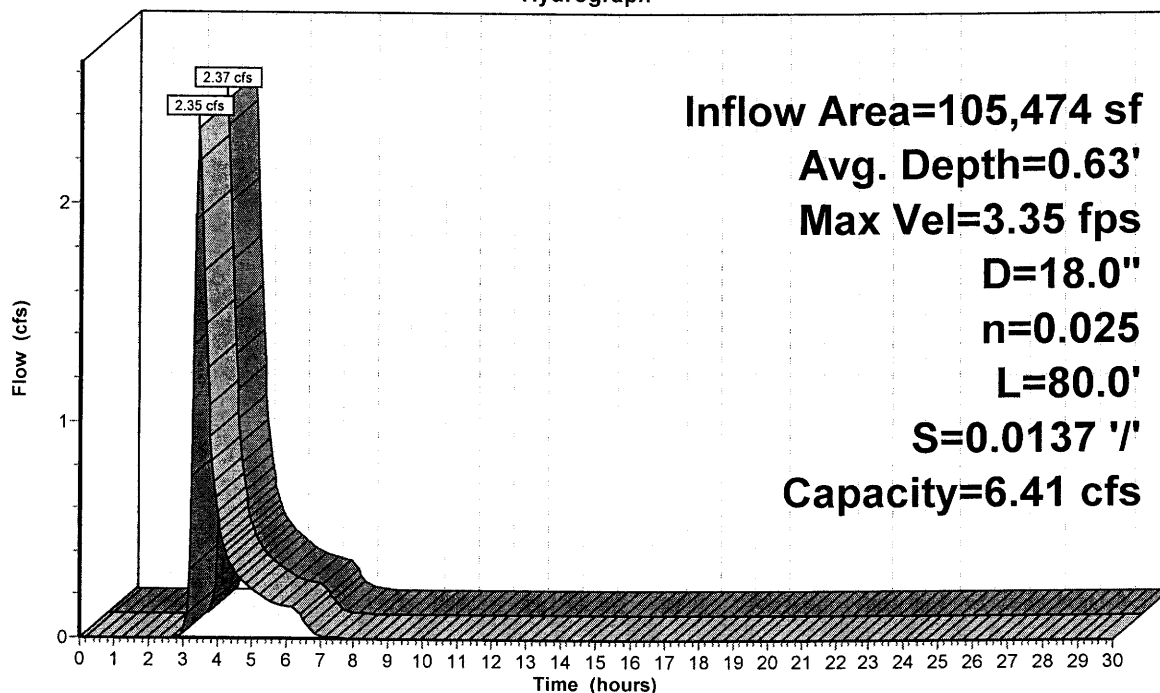
18.0" Diameter Pipe, n= 0.025 Corrugated metal

Length= 80.0' Slope= 0.0137 '/'

Inlet Invert= 5,512.00', Outlet Invert= 5,510.90'

**Reach C4: Culvert C-4**

Hydrograph



■ Inflow  
 ■ Outflow

**100yr-6hr West Pond**

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Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach C5: Culvert C-5**

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach W1DL OUTLET depth by 1.92' @ 2.70 hrs

[62] Warning: Exceeded Reach W3D OUTLET depth by 2.02' @ 3.45 hrs

Inflow Area = 305,034 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 5.67 cfs @ 3.30 hrs, Volume= 17,985 cf  
 Outflow = 5.67 cfs @ 3.30 hrs, Volume= 17,985 cf, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 11.15 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 3.89 fps, Avg. Travel Time= 0.1 min

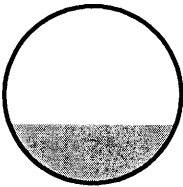
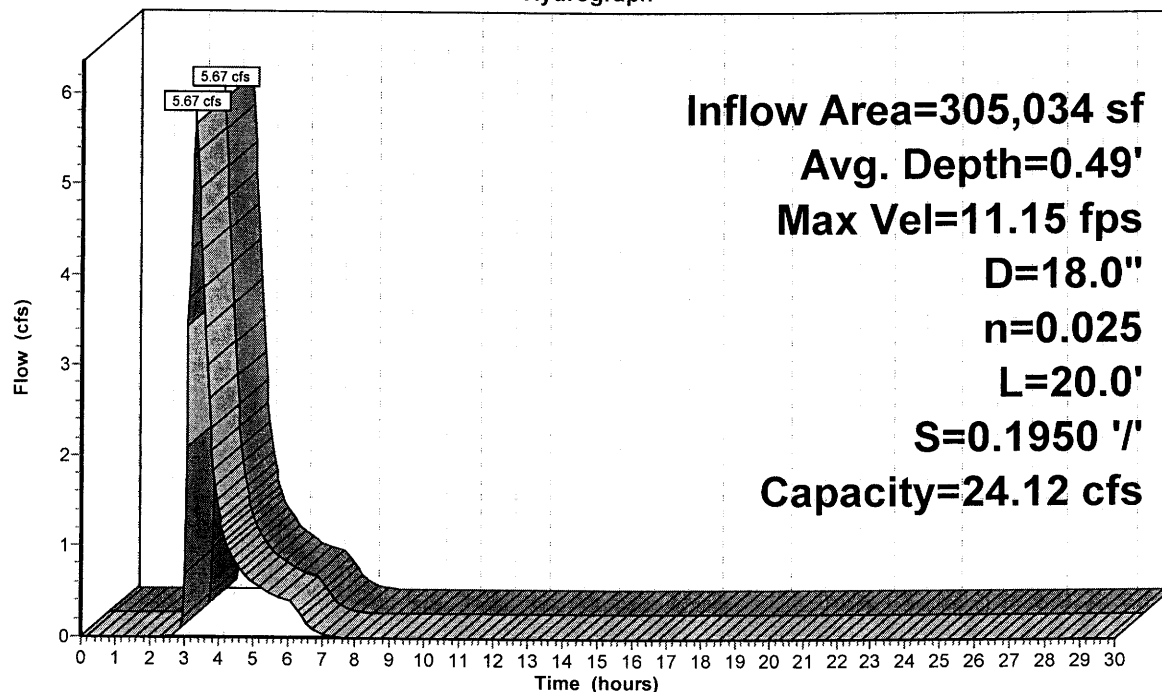
Peak Storage= 10 cf @ 3.30 hrs, Average Depth at Peak Storage= 0.49'

Bank-Full Depth= 1.50', Capacity at Bank-Full= 24.12 cfs

18.0" Diameter Pipe, n= 0.025 Corrugated metal

Length= 20.0' Slope= 0.1950 '/'

Inlet Invert= 5,509.90', Outlet Invert= 5,506.00'

**Reach C5: Culvert C-5****Hydrograph**

■ Inflow  
 ■ Outflow

**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach W1DL: Lower W-1 Ditch**

[62] Warning: Exceeded Reach C3 OUTLET depth by 0.60' @ 3.50 hrs

[62] Warning: Exceeded Reach C4 OUTLET depth by 0.60' @ 3.20 hrs

Inflow Area = 234,198 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 5.01 cfs @ 3.23 hrs, Volume= 13,809 cf  
 Outflow = 4.90 cfs @ 3.32 hrs, Volume= 13,809 cf, Atten= 2%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.35 fps, Min. Travel Time= 2.3 min

Avg. Velocity = 0.71 fps, Avg. Travel Time= 7.5 min

Peak Storage= 672 cf @ 3.27 hrs, Average Depth at Peak Storage= 1.03'

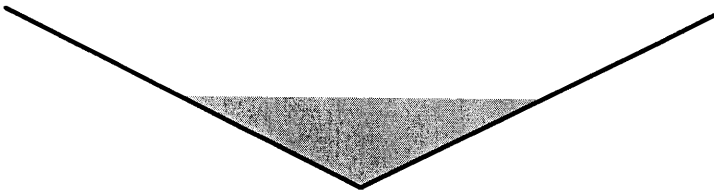
Bank-Full Depth= 2.00', Capacity at Bank-Full= 29.49 cfs

0.00' x 2.00' deep channel, n= 0.035

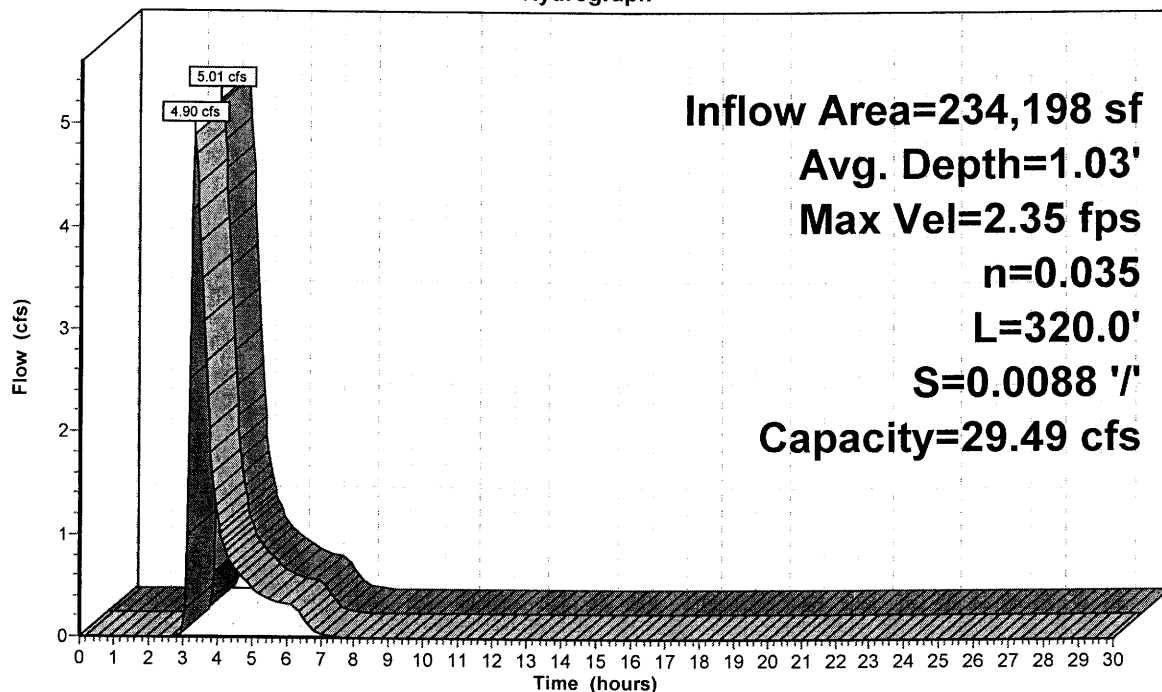
Side Slope Z-value= 2.0 '/' Top Width= 8.00'

Length= 320.0' Slope= 0.0088 '/'

Inlet Invert= 5,510.80', Outlet Invert= 5,508.00'

**Reach W1DL: Lower W-1 Ditch**

Hydrograph



■ Inflow  
 ■ Outflow

**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach W1DU: Upper W-1 Ditch**

Inflow Area = 105,474 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 2.88 cfs @ 3.22 hrs, Volume= 6,219 cf  
 Outflow = 2.37 cfs @ 3.43 hrs, Volume= 6,219 cf, Atten= 18%, Lag= 12.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.38 fps, Min. Travel Time= 6.7 min

Avg. Velocity = 0.77 fps, Avg. Travel Time= 20.8 min

Peak Storage= 971 cf @ 3.31 hrs, Average Depth at Peak Storage= 0.71'

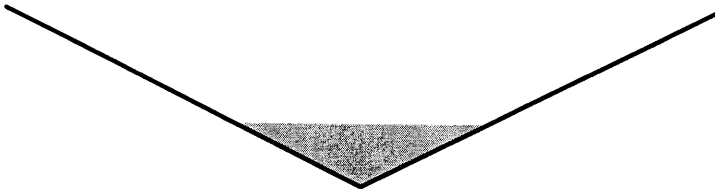
Bank-Full Depth= 2.00', Capacity at Bank-Full= 38.02 cfs

0.00' x 2.00' deep channel, n= 0.035

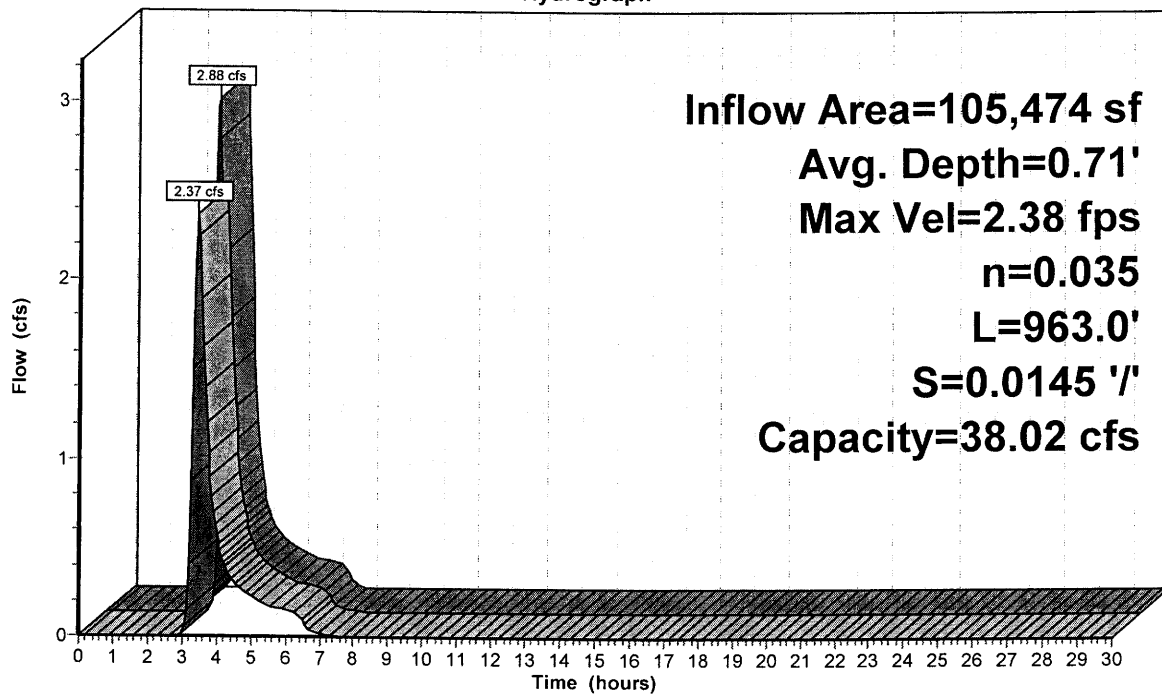
Side Slope Z-value= 2.0 '/' Top Width= 8.00'

Length= 963.0' Slope= 0.0145 '/'

Inlet Invert= 5,524.80', Outlet Invert= 5,510.80'

**Reach W1DU: Upper W-1 Ditch**

Hydrograph



■ Inflow  
 ■ Outflow

**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach W2D: W-2 Ditch**

Inflow Area = 128,724 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 5.32 cfs @ 3.11 hrs, Volume= 7,590 cf  
 Outflow = 4.68 cfs @ 3.21 hrs, Volume= 7,590 cf, Atten= 12%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.58 fps, Min. Travel Time= 3.2 min

Avg. Velocity = 0.62 fps, Avg. Travel Time= 13.3 min

Peak Storage= 918 cf @ 3.16 hrs, Average Depth at Peak Storage= 0.40'

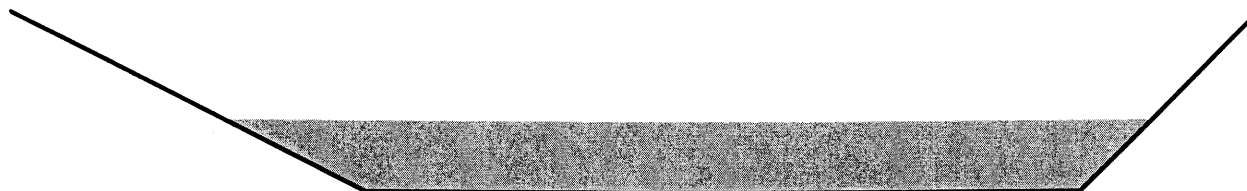
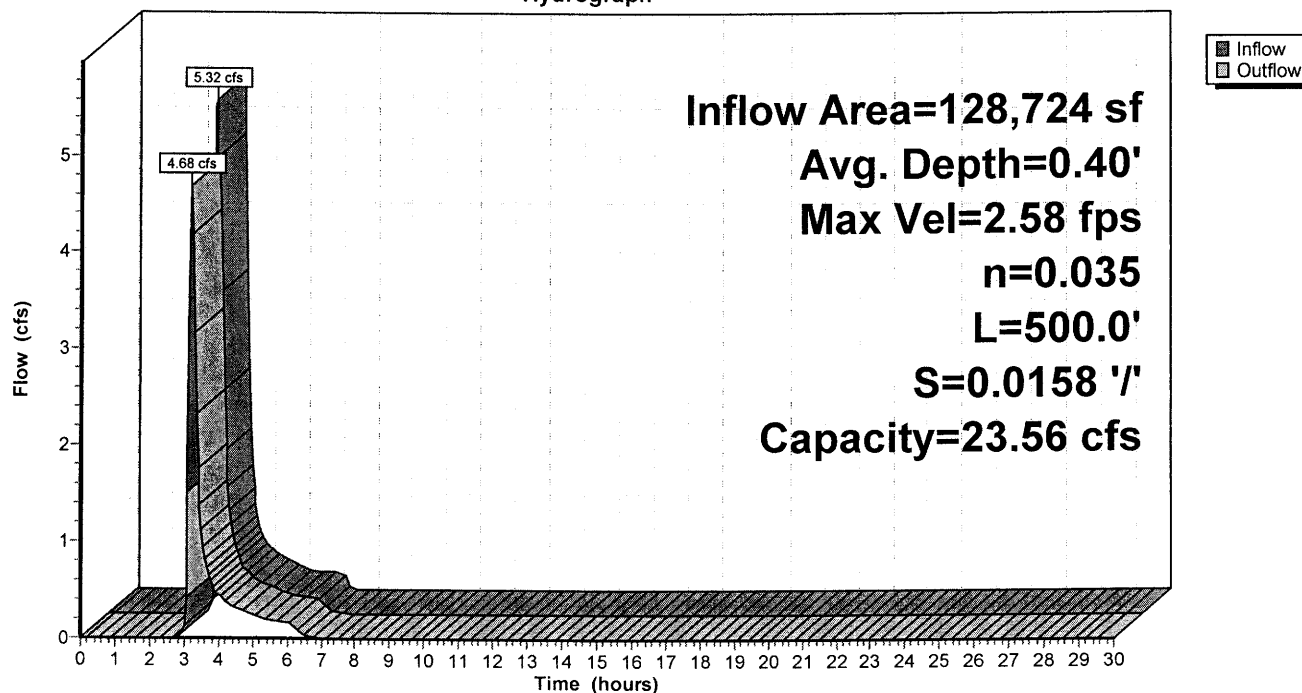
Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.56 cfs

4.00' x 1.00' deep channel, n= 0.035

Side Slope Z-value= 2.0 1.0 '/' Top Width= 7.00'

Length= 500.0' Slope= 0.0158 '/'

Inlet Invert= 5,520.00', Outlet Invert= 5,512.10'

**Reach W2D: W-2 Ditch****Hydrograph**



**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Reach W3D: W-3 Ditch**

Inflow Area = 70,836 sf, 0.00% Impervious, Inflow Depth = 0.71"  
 Inflow = 3.52 cfs @ 3.07 hrs, Volume= 4,177 cf  
 Outflow = 3.21 cfs @ 3.11 hrs, Volume= 4,177 cf, Atten= 9%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.50 fps, Min. Travel Time= 1.1 min

Avg. Velocity= 0.98 fps, Avg. Travel Time= 2.7 min

Peak Storage= 221 cf @ 3.10 hrs, Average Depth at Peak Storage= 0.71'

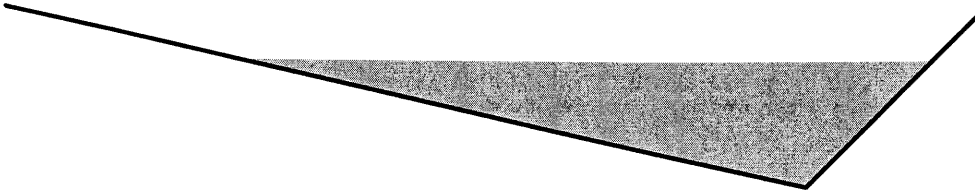
Bank-Full Depth= 1.00', Capacity at Bank-Full= 8.65 cfs

0.00' x 1.00' deep channel, n= 0.035

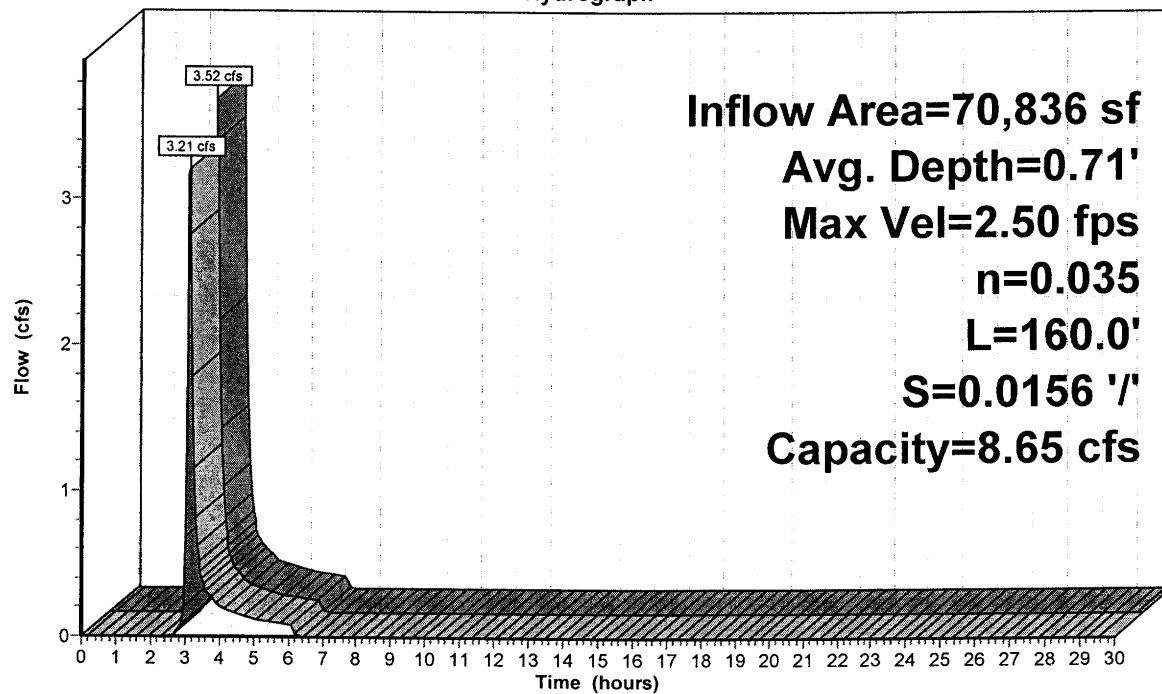
Side Slope Z-value= 4.5 1.0 '/' Top Width= 5.50'

Length= 160.0' Slope= 0.0156 '/'

Inlet Invert= 5,510.50', Outlet Invert= 5,508.00'

**Reach W3D: W-3 Ditch**

Hydrograph



■ Inflow  
 ■ Outflow

**100yr-6hr West Pond**

Type II 24-hr 6.00 hrs Rainfall=1.74"

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**Summary for Pond WP: West Sed Pond**

Inflow Area = 305,034 sf, 0.00% Impervious, Inflow Depth = 0.71"  
Inflow = 5.67 cfs @ 3.30 hrs, Volume= 17,985 cf  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

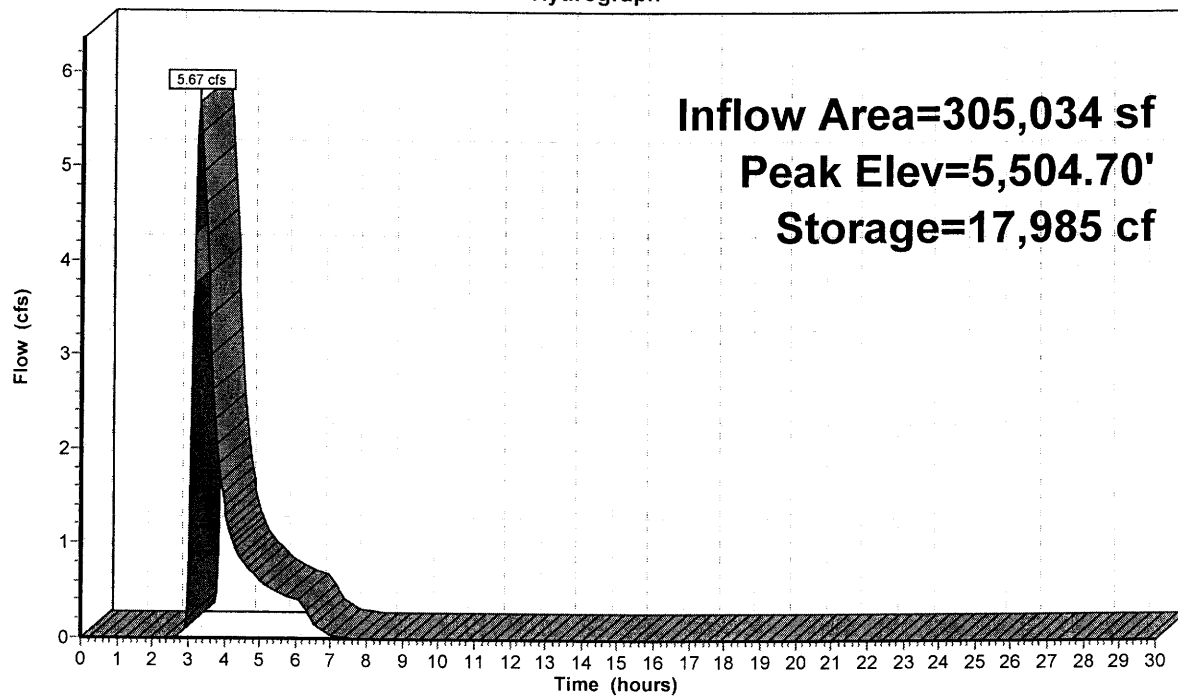
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Peak Elev= 5,504.70' @ 29.95 hrs Surf.Area= 4,455 sf Storage= 17,985 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

| Volume | Invert    | Avail.Storage | Storage Description                         |
|--------|-----------|---------------|---|
| #1     | 5,498.23' | 36,065 cf     | 17.00'W x 78.00'L x 9.77'H Prismatoid Z=2.0 |

**Pond WP: West Sed Pond**

Hydrograph



**Upper E-1, Min Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.011000 ft/ft |
| Left Side Slope      | 1.00 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Discharge            | 1.75 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.91 ft             |
| Flow Area        | 0.8 ft <sup>2</sup> |
| Wetted Perimeter | 2.58 ft             |
| Top Width        | 1.83 ft             |
| Critical Depth   | 0.72 ft             |
| Critical Slope   | 0.039876 ft/ft      |
| Velocity         | 2.10 ft/s           |
| Velocity Head    | 0.07 ft             |
| Specific Energy  | 0.98 ft             |
| Froude Number    | 0.55                |
| Flow Type        | Subcritical         |

**Upper E-1, Max Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.019000 ft/ft |
| Left Side Slope      | 1.00 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Discharge            | 1.75 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.82 ft             |
| Flow Area        | 0.7 ft <sup>2</sup> |
| Wetted Perimeter | 2.33 ft             |
| Top Width        | 1.65 ft             |
| Critical Depth   | 0.72 ft             |
| Critical Slope   | 0.039876 ft/ft      |
| Velocity         | 2.57 ft/s           |
| Velocity Head    | 0.10 ft             |
| Specific Energy  | 0.93 ft             |
| Froude Number    | 0.71                |
| Flow Type        | Subcritical         |

**Lower E-1, Min Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.013000 ft/ft |
| Left Side Slope      | 1.50 H : V     |
| Right Side Slope     | 1.50 H : V     |
| Discharge            | 1.75 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.73 ft             |
| Flow Area        | 0.8 ft <sup>2</sup> |
| Wetted Perimeter | 2.63 ft             |
| Top Width        | 2.19 ft             |
| Critical Depth   | 0.61 ft             |
| Critical Slope   | 0.033882 ft/ft      |
| Velocity         | 2.19 ft/s           |
| Velocity Head    | 0.07 ft             |
| Specific Energy  | 0.80 ft             |
| Froude Number    | 0.64                |
| Flow Type        | Subcritical         |

**Lower E-1, Max Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.021000 ft/ft |
| Left Side Slope      | 1.50 H : V     |
| Right Side Slope     | 1.50 H : V     |
| Discharge            | 1.75 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.67 ft             |
| Flow Area        | 0.7 ft <sup>2</sup> |
| Wetted Perimeter | 2.41 ft             |
| Top Width        | 2.00 ft             |
| Critical Depth   | 0.61 ft             |
| Critical Slope   | 0.033882 ft/ft      |
| Velocity         | 2.62 ft/s           |
| Velocity Head    | 0.11 ft             |
| Specific Energy  | 0.77 ft             |
| Froude Number    | 0.80                |
| Flow Type        | Subcritical         |

**E-3, Min Slope**  
**Worksheet for Trapezoidal Channel**

| Project Description |                         |
|---------------------|-------------------------|
| Worksheet           | Trapezoidal Channel - 1 |
| Flow Element        | Trapezoidal Channel     |
| Method              | Manning's Formula       |
| Solve For           | Channel Depth           |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.015000 ft/ft |
| Left Side Slope      | 2.50 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Bottom Width         | 0.50 ft        |
| Discharge            | 4.80 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.84 ft             |
| Flow Area        | 1.7 ft <sup>2</sup> |
| Wetted Perimeter | 3.94 ft             |
| Top Width        | 3.44 ft             |
| Critical Depth   | 0.73 ft             |
| Critical Slope   | 0.028443 ft/ft      |
| Velocity         | 2.91 ft/s           |
| Velocity Head    | 0.13 ft             |
| Specific Energy  | 0.97 ft             |
| Froude Number    | 0.74                |
| Flow Type        | Subcritical         |

**E-3, Max Slope**  
**Worksheet for Trapezoidal Channel**

| Project Description |                         |
|---------------------|-------------------------|
| Worksheet           | Trapezoidal Channel - 1 |
| Flow Element        | Trapezoidal Channel     |
| Method              | Manning's Formula       |
| Solve For           | Channel Depth           |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.023000 ft/ft |
| Left Side Slope      | 2.50 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Bottom Width         | 0.50 ft        |
| Discharge            | 4.80 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.76 ft             |
| Flow Area        | 1.4 ft <sup>2</sup> |
| Wetted Perimeter | 3.64 ft             |
| Top Width        | 3.18 ft             |
| Critical Depth   | 0.73 ft             |
| Critical Slope   | 0.028443 ft/ft      |
| Velocity         | 3.41 ft/s           |
| Velocity Head    | 0.18 ft             |
| Specific Energy  | 0.95 ft             |
| Froude Number    | 0.90                |
| Flow Type        | Subcritical         |



## E-4, Constant Slope Worksheet for Triangular Channel

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.016000 ft/ft |
| Left Side Slope      | 2.00 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Discharge            | 1.16 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.60 ft             |
| Flow Area        | 0.5 ft <sup>2</sup> |
| Wetted Perimeter | 2.20 ft             |
| Top Width        | 1.81 ft             |
| Critical Depth   | 0.52 ft             |
| Critical Slope   | 0.036385 ft/ft      |
| Velocity         | 2.12 ft/s           |
| Velocity Head    | 0.07 ft             |
| Specific Energy  | 0.67 ft             |
| Froude Number    | 0.68                |
| Flow Type        | Subcritical         |

**E-5, Min Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.009500 ft/ft |
| Left Side Slope      | 4.00 H : V     |
| Right Side Slope     | 4.00 H : V     |
| Discharge            | 4.98 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.76 ft             |
| Flow Area        | 2.3 ft <sup>2</sup> |
| Wetted Perimeter | 6.30 ft             |
| Top Width        | 6.11 ft             |
| Critical Depth   | 0.63 ft             |
| Critical Slope   | 0.027371 ft/ft      |
| Velocity         | 2.13 ft/s           |
| Velocity Head    | 0.07 ft             |
| Specific Energy  | 0.83 ft             |
| Froude Number    | 0.61                |
| Flow Type        | Subcritical         |

**E-5, Max Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.033000 ft/ft |
| Left Side Slope      | 4.00 H : V     |
| Right Side Slope     | 4.00 H : V     |
| Discharge            | 4.98 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.60 ft             |
| Flow Area        | 1.5 ft <sup>2</sup> |
| Wetted Perimeter | 4.99 ft             |
| Top Width        | 4.84 ft             |
| Critical Depth   | 0.63 ft             |
| Critical Slope   | 0.027371 ft/ft      |
| Velocity         | 3.40 ft/s           |
| Velocity Head    | 0.18 ft             |
| Specific Energy  | 0.78 ft             |
| Froude Number    | 1.09                |
| Flow Type        | Supercritical       |

**Upper W-1, Min Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.009100 ft/ft |
| Left Side Slope      | 2.00 H : V     |
| Right Side Slope     | 2.00 H : V     |
| Discharge            | 1.50 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.65 ft             |
| Flow Area        | 0.8 ft <sup>2</sup> |
| Wetted Perimeter | 2.91 ft             |
| Top Width        | 2.60 ft             |
| Critical Depth   | 0.51 ft             |
| Critical Slope   | 0.032636 ft/ft      |
| Velocity         | 1.78 ft/s           |
| Velocity Head    | 0.05 ft             |
| Specific Energy  | 0.70 ft             |
| Froude Number    | 0.55                |
| Flow Type        | Subcritical         |

**Upper W-1, Max Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.025000 ft/ft |
| Left Side Slope      | 2.00 H : V     |
| Right Side Slope     | 2.00 H : V     |
| Discharge            | 1.50 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.54 ft             |
| Flow Area        | 0.6 ft <sup>2</sup> |
| Wetted Perimeter | 2.40 ft             |
| Top Width        | 2.15 ft             |
| Critical Depth   | 0.51 ft             |
| Critical Slope   | 0.032635 ft/ft      |
| Velocity         | 2.60 ft/s           |
| Velocity Head    | 0.10 ft             |
| Specific Energy  | 0.64 ft             |
| Froude Number    | 0.88                |
| Flow Type        | Subcritical         |

**Lower W-1, Min Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.006700 ft/ft |
| Left Side Slope      | 2.00 H : V     |
| Right Side Slope     | 2.00 H : V     |
| Discharge            | 2.44 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.83 ft             |
| Flow Area        | 1.4 ft <sup>2</sup> |
| Wetted Perimeter | 3.69 ft             |
| Top Width        | 3.30 ft             |
| Critical Depth   | 0.62 ft             |
| Critical Slope   | 0.030586 ft/ft      |
| Velocity         | 1.79 ft/s           |
| Velocity Head    | 0.05 ft             |
| Specific Energy  | 0.88 ft             |
| Froude Number    | 0.49                |
| Flow Type        | Subcritical         |

**Lower W-1, Max Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.017000 ft/ft |
| Left Side Slope      | 2.00 H : V     |
| Right Side Slope     | 2.00 H : V     |
| Discharge            | 2.44 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.69 ft             |
| Flow Area        | 1.0 ft <sup>2</sup> |
| Wetted Perimeter | 3.10 ft             |
| Top Width        | 2.77 ft             |
| Critical Depth   | 0.62 ft             |
| Critical Slope   | 0.030586 ft/ft      |
| Velocity         | 2.54 ft/s           |
| Velocity Head    | 0.10 ft             |
| Specific Energy  | 0.79 ft             |
| Froude Number    | 0.76                |
| Flow Type        | Subcritical         |

**W-2, Min Slope**  
**Worksheet for Trapezoidal Channel**

| Project Description |                         |
|---------------------|-------------------------|
| Worksheet           | Trapezoidal Channel - 1 |
| Flow Element        | Trapezoidal Channel     |
| Method              | Manning's Formula       |
| Solve For           | Channel Depth           |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.008300 ft/ft |
| Left Side Slope      | 1.00 H : V     |
| Right Side Slope     | 2.00 H : V     |
| Bottom Width         | 2.00 ft        |
| Discharge            | 2.79 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.51 ft             |
| Flow Area        | 1.4 ft <sup>2</sup> |
| Wetted Perimeter | 3.86 ft             |
| Top Width        | 3.53 ft             |
| Critical Depth   | 0.36 ft             |
| Critical Slope   | 0.029556 ft/ft      |
| Velocity         | 1.98 ft/s           |
| Velocity Head    | 0.06 ft             |
| Specific Energy  | 0.57 ft             |
| Froude Number    | 0.55                |
| Flow Type        | Subcritical         |



**W-2, Max Slope**  
**Worksheet for Trapezoidal Channel**

| Project Description |                         |
|---------------------|-------------------------|
| Worksheet           | Trapezoidal Channel - 1 |
| Flow Element        | Trapezoidal Channel     |
| Method              | Manning's Formula       |
| Solve For           | Channel Depth           |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.033000 ft/ft |
| Left Side Slope      | 1.00 H : V     |
| Right Side Slope     | 2.00 H : V     |
| Bottom Width         | 2.00 ft        |
| Discharge            | 2.79 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.35 ft             |
| Flow Area        | 0.9 ft <sup>2</sup> |
| Wetted Perimeter | 3.26 ft             |
| Top Width        | 3.04 ft             |
| Critical Depth   | 0.36 ft             |
| Critical Slope   | 0.029556 ft/ft      |
| Velocity         | 3.20 ft/s           |
| Velocity Head    | 0.16 ft             |
| Specific Energy  | 0.51 ft             |
| Froude Number    | 1.05                |
| Flow Type        | Supercritical       |

**W-3, Min Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.003300 ft/ft |
| Left Side Slope      | 4.50 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Discharge            | 1.81 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.74 ft             |
| Flow Area        | 1.5 ft <sup>2</sup> |
| Wetted Perimeter | 4.48 ft             |
| Top Width        | 4.09 ft             |
| Critical Depth   | 0.49 ft             |
| Critical Slope   | 0.032311 ft/ft      |
| Velocity         | 1.19 ft/s           |
| Velocity Head    | 0.02 ft             |
| Specific Energy  | 0.77 ft             |
| Froude Number    | 0.34                |
| Flow Type        | Subcritical         |

**W-3, Max Slope**  
**Worksheet for Triangular Channel**

| Project Description |                        |
|---------------------|------------------------|
| Worksheet           | Triangular Channel - 1 |
| Flow Element        | Triangular Channel     |
| Method              | Manning's Formula      |
| Solve For           | Channel Depth          |

| Input Data           |                |
|----------------------|----------------|
| Mannings Coefficient | 0.035          |
| Slope                | 0.025000 ft/ft |
| Left Side Slope      | 4.50 H : V     |
| Right Side Slope     | 1.00 H : V     |
| Discharge            | 1.81 cfs       |

| Results          |                     |
|------------------|---------------------|
| Depth            | 0.51 ft             |
| Flow Area        | 0.7 ft <sup>2</sup> |
| Wetted Perimeter | 3.07 ft             |
| Top Width        | 2.80 ft             |
| Critical Depth   | 0.49 ft             |
| Critical Slope   | 0.032310 ft/ft      |
| Velocity         | 2.54 ft/s           |
| Velocity Head    | 0.10 ft             |
| Specific Energy  | 0.61 ft             |
| Froude Number    | 0.89                |
| Flow Type        | Subcritical         |